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LISTS AND ANALYSES

OF THE

MINERAL SPRINGS

OF THE

UNITED STATES

[A PRELIMINARY STUDY]

BY

ALBERT C. PEALE, M. D.



WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1886



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# MINERAL SPRINGS OF THE UNITED STATES.

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BY A. C. PEALE, M. D.

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## INTRODUCTION.

In attempting the collection of data for the statement of the commercial value of the mineral waters of the country for publication in the report on the Mineral Resources of the United States, 1883 and 1884,<sup>1</sup> it was necessary as a prerequisite to have a list of the springs from which these waters are derived: An examination of the few general works on the subject very soon showed that all existing lists were incomplete. The tables given in this paper were therefore compiled, as the first step in the preparation of the mineral spring statistics of the United States. They were omitted from the paper published in Mr. Williams's report, for want of space. Since the appearance of that report they have been revised and, with the addition of such analyses as could be obtained, prepared for publication as a bulletin of the Survey.

The most complete compilation previously made of the mineral springs of the United States is believed to be that brought together by a committee of the American Medical Association<sup>2</sup> and published in Vol. XXXI of the transactions of the association (1880). It enumerates about 500 localities. Walton's Mineral Springs of the United States and Canada, published in 1883 (third edition), mentions some 279 localities for the United States. Moorman's Mineral Springs of North America, issued in 1873, refers to or describes 171 springs. Bell's Baths and Mineral Waters, which bears the date of 1831, mentions 21 places, which are increased to 181 in his Mineral Springs of the United States and Canada, published in 1855. A. N. Bell's Climatology and Mineral Waters of the United States, published during the latter part of 1885, enumerates 173 localities. The lists prepared for the present compilation include 2,822 localities. Over 600 are places of resort and more than 200 sell the waters to a greater or less extent. The lists may not be complete as to the number of localities and certainly are

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<sup>1</sup> United States Geological Survey. Mineral Resources of the United States. Calendar years 1883 and 1884. Albert Williams, jr. Washington, 1885.

<sup>2</sup> Drs. William Pepper, H. I. Bowditch, A. N. Bell, S. E. Chaillé, and Charles Denison. The list is referred to in this paper as "Pepper's list."

not so far as the total number of individual springs is concerned, reports not having been received from all the localities. Still, they are published as preliminary to more detailed work, which it is hoped may follow in the future. The information has been derived primarily from the various State geological reports, State guide and hand books, Government geological reports and maps, and various scientific publications. To enumerate all these sources would be giving a large part of the bibliography of the subject, a work now in preparation. Much additional material has been obtained from members of the Geological Survey whose duties have taken them into so many portions of the country. Supplementary data have been received in answer to a special set of inquiries sent throughout the entire country, and efforts have been made to verify the matter presented in regard to the various localities by direct correspondence in each instance.

The answers to the questions, as a rule, have been very satisfactory. To mention all those to whom the writer is indebted on this score would be impracticable here.

Although the scope of this paper is far from that of a treatise upon the subject of mineral waters, it may perhaps be advisable to repeat here the definition of the term "mineral water." The definition will depend somewhat upon the point of view, whether it be that of the chemist or of the physician or of some one interested only in the commercial aspect of the subject. Water is itself a mineral and is rarely, if ever, found pure in its natural state. As Daubeny says,<sup>1</sup> the term "mineral water" in its most extended sense comprises every modification existing in nature of that universally diffused fluid, whether considered with reference to its sensible properties or to its action upon life. Usually, however, the term is restricted to such waters as contain an unusual amount of mineral matter or which are characterized by an unusual degree of heat. From a therapeutic point of view, all waters that have an effect upon the animal body are mineral waters, no matter how feebly mineralized they may be.

Where the springs have been improved or where the waters have been placed upon the market, the definition has been used in this paper in its widest sense, and therefore all such springs have been included in the tables. The mention of unimproved springs, however, has been restricted so far as possible to those of which the waters are mineralized to a more or less marked degree. A number of the springs included in the tables, although of considerable commercial importance, would perhaps be classed as indifferent when viewed in the light of their chemical composition. It must be remembered in this connection that chemical analyses will not always explain the effects of a mineral water.

<sup>1</sup> Report on the present state of our knowledge with respect to mineral and thermal waters, by Charles Daubeny, M. D., &c., in Sixth Report of the British Association for the Advancement of Science, p. 1, 1836.

Many springs which have acquired great reputations for their medicinal effects are found, upon chemical examination, to be not so highly mineralized as many potable waters. That their medicinal value is recognized and that they are sources of profit to their owners, and also indirectly an addition to the wealth of the localities in which they are located, seem sufficient reasons why such springs should be noted. It is not proposed to discuss the relative merits of the various springs.

The tables of analyses appended to the lists under the different States will give an idea as to the chemical composition of the various waters. At present the facts as to the therapeutic action of our mineral waters are so meager and our knowledge of their effects is so inexact that it would be useless to attempt their classification from a therapeutic standpoint.

Neither are the data sufficient for a *complete* reference of American springs to a chemical scheme of classification. Of the more than eight thousand springs in our lists only a few more than eight hundred have been analyzed, so that the definite chemical composition of at least nine-tenths of the springs is still unknown.

The classification of mineral waters is a subject the consideration of which would require a separate paper, as its discussion is beset with many difficulties. All that is necessary here is to indicate the principal divisions, to one or another of which the springs in the lists have been assigned in a general way. First, the waters are characterized in regard to their temperatures, as either thermal or non-thermal, the temperature column in the tables indicating, in most cases, to which of these classes the springs belong. Secondly, certain gases are usually present in the water of most springs, and these springs are indicated by the terms carbonated, sulphureted, carbureted, &c. They are also mentioned as chalybeate, alkaline, saline, calcic, silicious, or acid, according to their predominant or characteristic solid constituents, or by a combination of the terms when more than one is present in large quantity.

Brine springs and wells (with a few exceptions where they have been used for medicinal purposes) have been omitted from the tables, as they are generally utilized in the production and manufacture of salt, and are therefore not usually applied to the ordinary uses of mineral springs. They also formed the subject of separate discussion in the *Mineral Resources*, 1883-'84, for which this paper was originally prepared.

Tables of analyses of the springs for each State and Territory, so far as they have been analyzed, have been compiled, and an attempt has been made to get the analyses in the most authentic form. The results were found stated in some thirty or more ways.

The limited time in which this paper was prepared did not permit the reduction of the analyses to one standard, and they are incorporated in the tables mainly as given in the sources from which they were taken, with the exception that where expressed in grains to fractions of the gallon they were increased to grains per gallon. When not otherwise stated in the tables, the gallon mentioned is the standard United States

or wine gallon of 231 cubic inches. Whenever there has been a choice between two or more forms preference has been given to the one expressed as grains per gallon. Although this is not the most scientific method, the majority of the analyses are so expressed. Of 819 analyses 496 are stated in that form. It is popularly supposed to be the most intelligible to the greatest number of persons. But it may be questioned whether grains per gallon is an expression so readily understood as parts to the hundred thousand or parts in one million, &c. Comparatively few persons have very definite ideas as to how much a grain of any particular substance is. When the results of analyses are expressed as grains or parts in 100, 1,000, 6,000, &c.; it is only a matter of simple multiplication to bring them into comparable forms.

The figures in the tables, with few exceptions, have been carried out to but two decimal places. Only quantitative analyses are included, and where several analyses of a water have been made all are given with the dates, as far as they could be ascertained.

It is impossible to mention here all those to whom thanks are due for data used in the preparation of the chemical tables. In connection with each analysis is given the name of the analyst. A great many of the analyses have been taken from State geological reports, and particularly from reports of Government explorations in the case of the Western States. Various correspondents and spring-owners throughout the whole country have contributed information under this head. Others to whom the writer is especially indebted are mentioned under the different State headings in the following pages.

The grouping of the mineral springs of the United States geographically has been by States, according to the scheme of subdivision proposed by Mr. Henry Gannett, geographer of the Tenth Census.<sup>1</sup> This brings the springs of each region into the same section and seems preferable in the present case to an alphabetic arrangement.

The preliminary character of this paper must be kept in view, and it will be esteemed a favor if attention is called to any errors or cases of duplication that may have crept into these pages.

#### NORTHERN ATLANTIC STATES.

The Northern Atlantic States might, perhaps, be divided, so far as their geological features are concerned, into two divisions, viz, the New England States and those formerly included with the Middle States.

In the former the rocks are of the older formations, referable mainly to the Archean, sedimentary rocks occupying relatively small areas. To this is, perhaps, due the fact that the springs are, as a rule, somewhat less mineralized than are those of the remaining States. Alkaline waters are more frequent in the New England States than in the Middle

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<sup>1</sup> Census Bulletin No. 277. November 1, 1881.

States; but, in both, sulphureted and chalybeate springs predominate, forming more than one-half the whole number.

The Northern Atlantic States naturally have the greatest number of waters that are used commercially. This section has the greatest population in proportion to its area, has long been settled, and is wealthiest. All these are reasons why we might expect to find mineral waters used to a greater extent.

*Summary for Northern Atlantic States.*

States.	Number of spring lo- calities.	Number of individual springs.	Number of springs analyzed.	Number of spring lo- calities utilized as resorts.	Number of springs used com- mercially.	Total num- ber of analyses.
Maine .....	41	49	20	9	11	22
New Hampshire .....	12	27	8	8	4	8
Vermont .....	47	74	8	11	7	10
Massachusetts .....	24	31	7	2	7	8
Rhode Island .....	6	17	2	0	2	2
Connecticut .....	16	20	2	2	2	2
New York .....	200	343	72	25	34	94
New Jersey .....	13	13	8	1	0	8
Pennsylvania .....	46	83	28	16	5	33
Total .....	405	657	155	74	72	187

MAINE.

The mineral springs of Maine belong to the classes of alkaline, saline, and chalybeate waters, the last predominating. Many are sulphureted and a few carbonated. None is thermal, the highest temperature attained, so far as we can learn, being but 50° Fahr. Most of the temperatures range from 40° Fahr. to 46° Fahr.

The amount of mineral matter contained in the waters is usually small and some of the waters would be classed as chemically indifferent. A considerable number are utilized, both commercially and as places of resort. Dr. Goodale's "report on the mineral waters of Maine," in the sixth annual report of Professor Hitchcock to the Maine board of agriculture, made in 1861, is about the only publication in which the mineral waters of the State are treated of systematically. Since that date, however, a number of springs have been discovered, and several of them brought into prominent notice, while others, then used as resorts, have fallen into disuse.

*Mineral springs of Maine.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Addison Mineral Spring, Addison, Washington County.	1	1,800	45	Alkaline, calcic.	The water is sold.
American Chalybeate Spring, South Auburn, Androscoggin County.	1	.....	.....	Alkaline.....	Do.
Auburn Mineral Spring, South Auburn, Androscoggin County.	1	.....	.....	do .....	Do.
Bethel Spring, near Bethel, Oxford County.	.....	.....	42	Chalybeate and sulphureted.	Used commercially and as a resort.
Boothbay Medicinal Mineral Spring East Boothbay, Lincoln County.	1	300	46	Sulphureted....	
<i>Chalybeate springs:</i>					
At Andover, Oxford County .....	.....	.....	.....	.....	Water is sold.
At Biddeford, York County .....	.....	.....	.....	.....	
At Dixmont, Penobscot County....	1	.....	.....	.....	
At Gorham, Cumberland County....	.....	.....	.....	.....	
At Harpswell, Cumberland County	.....	.....	.....	.....	
At Newry, Oxford County .....	.....	.....	.....	.....	
At Topsham, Sagadahoc County...	.....	.....	.....	.....	
On Island in Portland harbor, Cum- berland County.	.....	.....	.....	.....	
On Upper St. John, near Great Black River, Aroostook County.	.....	.....	.....	.....	
Crystal Spring, 1 mile south of Auburn, Androscoggin County.	1	.....	.....	.....	
Dexter Chalybeate Spring, Dexter, Penobscot County.	.....	.....	.....	.....	Carbonated, chalybeate.
Ebeeme Spring .....	.....	.....	.....	do .....	
Fryeburg Spring, west part of Frye- burg, Oxford County.	.....	.....	43	.....	Used commercially and as a resort.
Hartford Cold Springs, Hartford, Ox- ford County.	3	.....	45	Saline .....	
Katahdin Mineral Springs. Katahdin Iron Works, Piscataquis County.	3	.....	.....	Sulpho - chalyb- eate.	Used commercially and as a resort.
Lake Auburn Mineral Spring, North Auburn, Androscoggin County.	1	2,000	40	Alkaline.....	
Lubec Saline Springs, head of Lubec Bay, Washington County.	.....	.....	.....	Saline .....	Very pure water, said to have medicinal effect. Used commercially and as a resort. Do. Do.
Ludlow Mineral Spring, Ludlow Town- ship, Aroostook County.	1	40	.....	.....	
Machiasport Spring, west part of Ma- chiasport, Washington County.	.....	.....	.....	Saline .....	
Mount Zircon Spring, Milton Planta- tion, Oxford County.	.....	.....	.....	do .....	
North Waterford Springs, northwest of Waterford Village, Oxford County.	.....	.....	40	Sulpho - chalyb- eate.	
Paradise Spring, near Brunswick, Cumberland County.	1	.....	.....	.....	
Poland Spring, South Poland, Andro- scoggin County.	1	490	51	Alkaline.....	
Poland Silica Springs, South Poland, Androscoggin County.	3	480+	.....	do .....	
Rosierucian Springs, Rosierucian, Lin- coln County.	3+	800	50	Alkaline, saline	
Samoset Mineral Springs, Noblebor- ough, Lincoln County.	.....	.....	.....	Alkaline.....	
Scarborough Mineral Spring, Scarbor- ough, Cumberland County.	1	300	45	Alkaline, cha- lybeate.	Do.
<i>Sulphur springs:</i>					
In New Limerick Township, Aroos- took Co.	.....	.....	.....	.....	Sulpho - chalyb- eate.
In Saccarappa, Cumberland County Near Wells, York County.....	.....	.....	.....	.....	
Near Mount Pleasant, Oxford Co ..	.....	.....	.....	.....	Do.
Summit Mineral Spring, Harrison, Cumberland County.	1	2,280	46	Alkaline.....	
Togus Spring, near Augusta, Kenne- bec County.	.....	.....	.....	.....	Was once a resort.
Vienna Spring, Vienna, Kennebec Co ..	.....	.....	.....	.....	
West Bethel Spring, near West Bethel Station, Oxford County.	.....	.....	42	Carbonated, cha- lybeate.	
West Newfield Spring, 2 miles from West Newfield, York County.	.....	.....	.....	Sulphureted....	

*Analyses of mineral springs in Maine.*

Constituents.	Samoset Mineral Springs.	Scarborough Spring.		Summit Mineral Spring.	West Bethel Spring.
	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. in 10,000.<sup>b</sup></i>	<i>Grs. per gall.<sup>c</sup></i>	<i>Grs. per gall.<sup>d</sup></i>	<i>Grs. in 6,000.<sup>b</sup></i>
Sodium carbonate .....	16.20		1.27	<sup>a</sup> 1.402	
Sodium bicarbonate .....				0.248	
Magnesium carbonate .....	0.39		0.93	0.990	
Magnesium bicarbonate .....		Trace			2.24
Calcium carbonate .....	1.09		1.65		
Calcium bicarbonate .....					
Iron carbonate .....	2.28		1.54		
Iron bicarbonate .....			0.84		
Potassium sulphate .....		2.01			
Magnesium sulphate .....		1.02	0.82		
Calcium sulphate .....	3.07				2.23
Iron sulphate .....					0.32
Aluminium sulphate .....					
Sodium chloride .....	1.09	26.05	1.06	0.171	
Potassium chloride .....		0.52			
Magnesium chloride .....		2.12			
Magnesium bromide .....		Trace			
Potash .....	Trace				
Alumina .....	Trace		Trace	Trace	
Magnesia .....					0.10
Lime .....					0.04
Silica .....	0.73		0.98	0.980	
Organic matter .....	Trace			} 0.238 {	
Volatile matter .....					
Loss .....		0.18			0.99
Total .....	24.85	31.90	9.09	4.029	5.92

Constituents.	Lubec Saline Springs.	North Waterford Springs.	Paradise Spring.	Poland Silica Springs.	
				Star Spring.	Fountain Head Spring.
	<i>Grs. imp. gall.<sup>f</sup></i>	<i>Grs. in 8,000.<sup>b</sup></i>	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. per gall.<sup>e</sup></i>	<i>Grs. per gall.<sup>g</sup></i>
Sodium carbonate .....			0.36		
Magnesium carbonate .....			0.06	0.82	
Magnesium bicarbonate .....					Traces
Calcium carbonate .....	6.25		0.07	2.33	
Calcium bicarbonate .....					1.39
Iron carbonate .....	2.50			2.24	
Sodium sulphate .....	27.98	0.42			
Potassium sulphate .....				0.90	0.12
Calcium sulphate .....	11.21		0.06		
Iron sulphate .....		4.01			
Aluminium sulphate .....		2.73			
Sodium chloride .....	199.00		0.02	4.85	1.51
Potassium chloride .....			0.04		
Magnesium chloride .....	62.84				
Calcium chloride .....	} 12.72 {				
Loss .....					
Iron oxide .....			Trace.		
Alumina .....				<sup>b</sup> 0.32	
Magnesia .....		} .09 {			
Lime .....					
Silica .....			0.38	0.58	0.93
Organic matter .....				2.25	
Total .....	322.50	7.25	0.99	14.29	3.95

<sup>a</sup> Henry Carmichael, analyst.

<sup>b</sup> George L. Goodale, analyst (1861).

<sup>c</sup> S. Dana Hayes, analyst (1876).

<sup>d</sup> F. L. Bartlett, analyst (1875).

<sup>e</sup> With potassium carbonate.

<sup>f</sup> C. T. Jackson, analyst.

<sup>g</sup> F. L. Bartlett, analyst.

<sup>h</sup> With iron.

*Analyses of mineral springs in Maine—Continued.*

Constituents.	Poland Spring.		Roscierucian Springs.		Addison Mineral Spring.
			Roscierucian Spring.	Ashburton Spring.	
	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. per gall.<sup>b</sup></i>	<i>Grs. per gall.<sup>c</sup></i>	<i>Grs. per gall.<sup>d</sup></i>	<i>Grs. per gall.<sup>a</sup></i>
Sodium carbonate .....	0.09	0.13			
Sodium bicarbonate .....			7.48	0.94	0.443
Magnesium carbonate .....	0.30	0.54			
Magnesium bicarbonate .....			1.04	0.29	1.122
Calcium carbonate .....	1.36	1.23			
Calcium bicarbonate .....			2.67	0.47	2.646
Iron carbonate .....	Trace				
Iron bicarbonate .....					1.651
Sodium sulphate .....			0.95		0.266
Potassium sulphate .....	0.18	0.16	2.31	0.19	0.601
Calcium sulphate .....					0.524
Sodium chloride .....	0.47	0.26	19.86	0.20	0.887
Sodium iodide .....			} Trace {		
Sodium bromide .....					
Calcium fluoride .....	Trace				
Lithia .....	Trace				
Iron oxide .....		Trace	0.07		
Alumina .....	Trace	Trace	0.03	} Trace {	Trace
Silica .....	1.07	1.12			
Silicic acid in solution .....			1.02	0.96	
Organic matter .....	0.28	} 0.23 {	} .....		
Volatile matter .....					
Total .....	3.75	3.67	35.43	3.05	8.140

Constituents.	Boothbay Medicinal Spring.	Ebeeme Spring.	Fryeburg Spring.	Hartford Cold Springs.	Lake Auburn Mineral Spring.
	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. in 6,000.<sup>f</sup></i>	<i>Grs. in 6,000.<sup>f</sup></i>	<i>Grs. per gall.<sup>g</sup></i>	<i>Grs. per gall.<sup>h</sup></i>
Sodium bicarbonate .....					1.20
Magnesium bicarbonate .....	1.01			1.92	0.30
Calcium bicarbonate .....	3.33			23.27	0.43
Iron carbonate .....		5.62	2.10		
Iron bicarbonate .....	2.73			0.31	
Potassium sulphate .....	1.99			4.05	0.18
Calcium sulphate .....		12.01			
Iron sulphate .....	0.81	1.23	1.21		
Sodium chloride .....	1.88			12.39	0.26
Potassium chloride .....				1.07	
Magnesium chloride .....				0.97	
Iron oxide .....					Trace
Alumina .....	Trace			0.24	Trace
Magnesia .....		0.11			
Lime .....			0.10		
Silica .....	0.64			0.46	
Silicic acid in solution .....					1.41
Organic matter .....	Trace				
Total .....	12.39	8.97	3.41	44.68	3.78

Constituents.	American Chalybeate Spring.	Auburn Mineral Spring.
	<i>Grains per gall.<sup>i</sup></i>	<i>Grains per gall.<sup>j</sup></i>
Calcium carbonate .....	3.935	0.814
Magnesium carbonate .....	1.102	0.128
Iron carbonate .....	0.737	
Potassium sulphate .....	0.844	0.229
Iron sulphate .....	0.320	
Sodium chloride .....	0.334	0.176
Iron .....		Trace
Alumina .....	} 0.648 {	Trace
Silica .....		0.683
Organic matter .....	0.242	0.242
Total .....	8.162	2.272

<sup>a</sup> F. L. Bartlett, analyst (1879).<sup>b</sup> C. F. Chandler, analyst.<sup>c</sup> S. Dana Hayes, analyst (1877).<sup>d</sup> S. Dana Hayes, analyst.<sup>e</sup> F. L. Bartlett, analyst (November 15, 1883).<sup>f</sup> George L. Goodale (1861).<sup>g</sup> Analyzed 1882.<sup>h</sup> S. Dana Hayes, analyst (1879).<sup>i</sup> With alumina.<sup>j</sup> F. L. Bartlett, analyst (1878).

NEW HAMPSHIRE.

Mr. G. W. Hawes, in Hitchcock's Geology of New Hampshire, says there are a large number of mineral springs in various parts of the State and that chalybeate waters are the most common. He mentions those of Pittsfield, Amherst, and Unity as the best known. Walton's book gives four localities. Pepper's list includes nine. In the present catalogue the number is increased to eleven.

A fair proportion are utilized commercially or as resorts, although as a rule the springs are not highly mineralized. In this respect they agree with most of the springs in the other New England States.

Mineral springs of New Hampshire.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Abenakis Springs, Walpole, Cheshire County.	.....	.....	o	.....	.....
Amherst Soda Springs, two miles from Amherst, Hillsborough County.	2	.....	.....	.....	Resort.
Birchdale Springs, near Concord, Merrimack County.	3	.....	.....	Calcic, chalybeate.	Used commercially and as a resort.
Bradford Mineral Spring, Bradford, Merrimack County.	1	2,000	46	Carbonated, saline.	Used commercially to a limited extent and as a resort.
Charlestown Springs, Charlestown, Sullivan County.	.....	.....	.....	Chalybeate	Unimportant.
Milford (Ponemah) Springs, Milford, Hillsborough County.	4	440	....	Chalybeate, &c	Used commercially and as a resort.
Moultonborough Mineral Spring, Moultonborough, Carroll County.	1	200	....	Chalybeate	Used commercially prior to 1882.
Pine Grove or Amherst Mineral Spring, Amherst, Hillsborough County.	1	60	....	Calcic, chalybeate.	Resort.
Sulpho-Chalybeate Spring, half mile northeast of Pittsfield, Merrimack County.	.....	.....	.....	.....	.....
Unity or Unitoga Springs, East Unity, Sullivan County.	10	500+	48	Alkaline or calcic saline.(?)	Do.
White Mountain Mineral Spring, Conway, Carroll County.	.....	.....	.....	Alkaline.....	Used commercially and as a resort.
Yacum Spring, Goffstown Centre, Hillsborough County.	1	120	48	Chalybeate	Resort.

Analyses of mineral springs in New Hampshire.

Constituents.	Milford Springs.			
	Iron Spring.	Magnesia Spring.	Ponemah Spring.	Milford Spring.
	Grains per gall. <sup>a</sup>	Grains per gall. <sup>a</sup>	Grains per gall. <sup>b</sup>	Grains per gall. <sup>a</sup>
Sodium carbonate.....	.....	.....	0.24	.....
Calcium carbonate.....	.....	2.00	0.34	.....
Magnesium carbonate.....	0.40	.....	.....	.....
Sodium chloride.....	.....	1.00	0.20	0.90
Sodium sulphate.....	0.40	.....	0.37	0.60
Potassium sulphate.....	.....	.....	0.07	1.80
Calcium sulphate.....	.....	1.04	.....	.....
Magnesium sulphate.....	.....	2.00	.....	.....
Iron sulphate.....	1.04	Trace	.....	1.00
Iron oxide.....	.....	.....	0.09	.....
Silica.....	.....	Trace	1.24	1.01
Alumina.....	1.04	.....	.....	.....
Magnesia.....	.....	.....	Trace	.....
Water.....	.....	.....	0.48	.....
Carbonic acid.....	In excess	Present	Present	Present
Total.....	2.88	6.04	3.03	5.31

<sup>a</sup> George E. Sewell, analyst (1882).

<sup>b</sup> John M. Ordway, analyst (1883).

<sup>c</sup> With soda.

*Analyses of mineral springs in New Hampshire—Continued.*

Constituents.	Birchdale Springs—Con- cord Spring.	White-Mountain Mineral Spring.	Pine Grove Mineral Spring.	Unity Springs— Iron Spring.
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per imp. gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>
Sodium carbonate.....			0.28	
Sodium bicarbonate.....	0.19			0.22
Calcium carbonate.....			5.66	
Calcium bicarbonate.....	2.09	0.65		4.17
Magnesium carbonate.....		0.11	1.47	
Magnesium bicarbonate.....	0.84			0.86
Iron carbonate.....		Trace	1.30	
Iron bicarbonate.....	0.37			
Sodium chloride.....	0.38	0.47	0.87	0.42
Sodium sulphate.....	0.26			
Potassium sulphate.....	0.07	0.18	0.35	0.10
Calcium sulphate.....			1.63	0.81
Sodium phosphate.....	0.01			
Iron oxide.....				2.16
Silica.....	0.92	0.67	{ 0.09 }	
Alumina.....	0.12	Trace		0.04
Organic matter.....	0.67			
Crenic acid.....			3.87	2.89
Carbonic acid.....			Undetermined	
Total.....	5.92	2.08	15.52	11.67

<sup>a</sup> C. F. Chandler, analyst (1873).<sup>b</sup> F. L. Bartlett, analyst (1882).<sup>c</sup> James A. Babcock, analyst.<sup>d</sup> S. Dana Hayes, analyst (1874).

## VERMONT.

In general the springs of Vermont are much like those of Maine and New Hampshire, except that they usually contain a larger proportion of mineral matter. This may be due in part to the fact that the rocks through which the springs rise belong more frequently to the sedimentary series. Sulphureted springs are most abundant. Of the springs whose character is indicated on the list, nearly all are included in this class. Calcareous tufa is found in connection with many of the springs.

Prof. Edward Hitchcock, in a letter to Prof. C. B. Adams,<sup>1</sup> in 1846, describes a thermal spring at Bennington. He does not give the temperature, but compares it with the spring at Williamstown, Mass., which is only slightly thermal. Clarendon, Alburgh, and Highgate springs appear to be the best known springs, although others are also largely used. The Clarendon springs are said to have been used medicinally in 1776, Alburgh has been a place of resort since 1816, and the use of Highgate dates back to 1840.

<sup>1</sup> Second Annual Report on Geology of Vermont, p. 250. Burlington, 1846.

*Mineral springs of Vermont.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Alburgh Springs, Alburgh Springs, Grand Isle County.	3	45	53	Saline, sulphureted.	Used commercially and as a resort.
Beardsley Iron Springs, Alburgh Springs, Grand Isle County.	3	.....	.....	Chalybeate and sulphureted.	Do.
Barre Mineral Springs, Barre, Washington County.	2	.....	.....	Sulphureted	Resort.
Bennington Thermal Spring, Bennington, Bennington County.	.....	.....	.....	.....	.....
Berkshire Mineral Springs, West Berkshire, Franklin County.	2	.....	.....	Sulphureted	.....
Bower Spring, near Hartland, Windsor County.	1	.....	.....	Sulphureted	Was a resort at one time.
Brunswick White Sulphur Springs, Brunswick, Essex County.	6	1,000	48	Chalybeate and sulphureted.	Used commercially and as a resort.
Central Spring, Sheldon, Franklin County.	.....	.....	.....	.....	.....
Champlain Spring, near Highgate, Franklin County.	1	160	.....	.....	Little used at present.
Chester Medicinal Spring, near Chester, Windsor County.	.....	.....	.....	Sulpho-chalybeate.	.....
Clarendon Mineral Springs, Clarendon Springs, Rutland County.	3	640	46 to 50	Carbonated, calcic.	Used commercially and as a resort.
Elgin Spring, Panton, Addison County.	1	.....	46	Saline	Used commercially.
Guilford Mineral Springs, Guilford Centre, Windham County.	3	.....	.....	Saline, chalybeate.	Five or six years ago used commercially and as a resort.
Haynes Mineral Spring, Hardwick, Caledonia County.	1	.....	.....	.....	Was once a resort.
Harrington Springs, 2 miles north of Quechee, Windsor County.	.....	.....	.....	.....	.....
Highgate Spring, Highgate Springs, Franklin County.	.....	.....	.....	Sulpho-saline	Resort.
Iodine Springs, near Berkshire, Franklin County.	6	.....	.....	Sulphureted	.....
Lunenburg Chalybeate Mineral Spring, Lunenburg, Essex County.	1	65	43	Chalybeate	Resort; also sold to some extent.
Martin's Spring, north part of Shaftsbury, Bennington County.	.....	.....	.....	.....	Unimproved; once had considerable reputation.
Middletown Mineral Springs, Middletown Springs, Rutland County.	3	.....	.....	.....	Used commercially and as a resort.
<i>Mineral springs:</i>					
Near Back, or Pilotsburg, North Hero, Grand Isle County.	.....	.....	.....	.....	.....
In South Hero, Grand Isle County.	2	.....	.....	.....	.....
West of Stowe, Lamoille County.	.....	.....	.....	.....	.....
In Williamstown, Orange County.	.....	.....	.....	.....	.....
In Cabot, Washington County	2	.....	.....	Iron and sulphur	Unimportant.
In Vernon, Windham County	.....	.....	.....	.....	.....
Missisquoi Spring, 3 miles south of Sheldon, Franklin County.	.....	.....	.....	.....	Used commercially.
Newbury Springs (Montebello Springs), Newbury, Orange County.	2	.....	48 to 55	Sulphureted, calcic, and chalybeate.	Resort.
North Wolcott Spring, North Wolcott, Lamoille County.	1	120+	.....	.....	Was once a resort.
Plainfield Spring, Plainfield, Washington County.	1	.....	.....	Sulphureted	Has been a resort.
Sanderson Spring, 3 miles south of Woodstock, Windsor County.	.....	.....	.....	.....	Used medicinally to a limited extent.
Sheldon Spring, Sheldon, Franklin County.	1	500	45	Alkaline, saline.	Used commercially and as a resort.
Sudbury Mineral Springs, Sudbury, Rutland County.	.....	.....	.....	.....	.....
<i>Sulphur springs:</i>					
Northeast of Orwell Centre, Addison County.	.....	.....	.....	.....	Has local reputation.
Two miles west of Tunbridge, Orange County.	.....	.....	.....	.....	.....

*Mineral springs of Vermont—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Sulphur springs—Continued.</i>			°		
One mile south of West Randolph, Orange County.					
Near Hartland Four Corners, Windsor County.					
Northeastern part of Arlington, Bennington County.					
Near Andover, Windsor County					
Western part of Sudbury, Rutland County.					Local reputation.
Near Chelsea, Orange Co	3				
Western part of Craftsbury, Orleans County.					
Northeast of Stowe, Lamoille Co.					
Near East Montpelier, Washington County.	1				Not important.
Vermont Springs, Sheldon, Franklin Co.					
Warren Springs, eastern part of Warren, Washington County.					
Welden Springs, St. Albans, Franklin County.					Unimproved and unused.

*Analyses of mineral springs in Vermont.*

Constituents.	Albargh Springs.	Clarendon Springs.	Guilford Mineral Springs.		Middletown Springs—Spring No. 1.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains in 1 cubic ft., about 7 gallons.<sup>d</sup></i>
Sodium carbonate			2.40		25.74
Magnesium carbonate			0.60		10.12
Calcium carbonate		3.02	15.18		26.81
Iron carbonate			2.99		10.68
Manganese carbonate					9.41
Magnesium sulphate		} 2.74 {			
Sodium sulphate	7.11				
Potassium sulphate	9.50				
Calcium sulphate					1.15
Sodium chloride	8.76		2.41		1.74
Potassium chloride					10.43
Magnesium chloride	5.02				
Calcium chloride	4.81				
Soda				0.76	
Potash				1.11	
Magnesia				1.51	
Limo				8.74	
Ammonia				Trace	
Ferrous oxide				0.85	
Alumina				Trace	0.67
Sodium				0.58	
Chlorine				0.88	
Sulphuric acid				0.69	
Carbonic acid (combined)				9.17	
Silicic acid				0.99	
Insoluble silica			0.60		
Insoluble matter	0.80				
Chronic acid.				} 1.64 {	
Organic matter.			5.60		
Organic soil acid	} 2.00 {				
Loss			0.40		
Total	38.00	5.76	30.18	26.92	96.75
<i>Gases.</i>		<i>Cubic inches.</i>			
Carbonic acid		46.16			
Nitrogen		9.63			

<sup>a</sup> C. T. Jackson, analyst (1868).<sup>b</sup> A. A. Hayes, analyst.<sup>c</sup> A. A. and S. Dana Hayes, analysts (1869).<sup>d</sup> Peter Collier, analyst.<sup>e</sup> With calcium chloride.<sup>f</sup> With potassium sulphide.<sup>g</sup> With calcium carbonate.<sup>h</sup> With traces of nitrate of potash.

*Analyses of mineral springs in Vermont—Continued.*

Constituents.	Highgate Springs.		Montebello or Newbury Springs.		Sheldon Spring.
	Champlain Spring.	Name unknown.			
	Grains per gallon. <sup>a</sup>	Grains per gallon. <sup>b</sup>	Grains per gallon. <sup>c</sup>	Grains per gallon. <sup>d</sup>	Grains per gallon. <sup>e</sup>
Sodium carbonate .....	1.22	13.70	0.40		
Potassium carbonate .....	3.67				
Magnesium carbonate .....	1.22	5.83	0.24		
Calcium carbonate .....	1.02	1.40	17.60		
Ammonium carbonate .....	Trace				
Iron carbonate .....				45.04	
Potassium nitrate .....			0.40		
Sodium sulphate .....		2.45	0.24	17.12	
Calcium sulphate .....				13.20	
Iron sulphate .....				48.60	
Iron phosphate .....			0.40		
Sodium chloride .....	0.17	23.44	0.32		
Potassium chloride .....	0.74				
Magnesium chloride .....				34.00	
Sodium sulphide .....			0.32		
Soda .....					4.01
Potash .....					0.09
Magnesia .....					0.17
Lime .....					1.08
Ammonia .....					Trace
Ferrous oxide .....	0.03		Trace		0.01
Sodium .....					0.15
Chlorine .....					0.16
Sulphuric acid .....					0.51
Carbonic acid (combined) .....					2.11
Silicic acid .....	0.81				4.59
Insoluble silica .....			8.80		
Organic matter .....			0.24		
Crenic acid .....	0.90				}
Loss .....			8.64		
Total .....	9.78	46.82	37.60	157.96	15.75

<sup>a</sup> A. A. Hayes, analyst.<sup>b</sup> T. Sterry Hunt, analyst (1867).<sup>c</sup> Professor Hall, analyst.<sup>d</sup> I. P. Dix, analyst.<sup>e</sup> S. Dana Hayes, analyst (1867).<sup>f</sup> With ammonia.

## MASSACHUSETTS.

The State of Massachusetts is not remarkable for the occurrence of mineral springs. The list contains twenty-one localities. In most lists only two are included, viz, Hopkinton Springs and the Berkshire Soda Springs. The former was once an important place of resort, but at present its springs are not utilized to any considerable extent. Brookfield and Shutesbury were also once much frequented.

Professor Hitchcock, in the reports on the geology of Massachusetts made in 1833 and 1849, says that chalybeate springs are common throughout the State, occurring in nearly every town, usually rising in low ground containing bog iron. Many of these springs have a local reputation and a few are used commercially. Such analyses as have been made show that as a rule the waters are not highly mineralized. A mineral spring near Williamstown is said to be slightly thermal and in the extreme southwestern part of the State, near Mount Washington, there is reported to be another similar spring.

*Mineral springs of Massachusetts.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Allandale Springs, West Roxbury, Suffolk County.	2	1, 250	55 to 60	Alkaline.....	Used commercially.
Berkshire Soda Springs, near Great Barrington, Berkshire County.	2	.....	.....	.....	Do.
Bethlehem Spring, Worcester Co., near Braggville.	1	.....	.....	Alkaline.....	Do.
Brookfield Spring, Brookfield, Worcester County.	.....	.....	.....	Carbonated chalybeate.	.....
<i>Chalybeate springs:</i> South Hadley, Hampshire County.	2	100	60	.....	Unimproved.
Deerfield, Franklin County	.....	.....	.....	.....	.....
Crystal Mineral Springs, Stoneham, Middlesex County.	2	.....	45 to 60	Slightly chalybeate.	Used commercially.
Coldbrook Mineral Springs, Coldbrook Springs, Worcester County.	2	.....	.....	Sulpho-chalybeate.	Resort.
Commonwealth Mineral Spring, Waltham, Middlesex County.	1	600	48	Alkaline.....	Used commercially.
Echo Grove Mineral Spring, Lynn, Essex County.	1	.....	.....	Carbonated.....	Used commercially and as a resort.
Everett Crystal Spring, Everett, Middlesex County.	1	3, 000	.....	Calcic-saline.....	Used commercially.
Hopkinton Springs, Hopkinton, Middlesex County.	.....	.....	.....	Carbonated chalybeate.	Was once a resort.
Mendon Mineral Springs, Mendon, Worcester County.	.....	.....	.....	Carbonated.....	.....
<i>Mineral springs:</i> Adams, Berkshire County	.....	.....	.....	.....	.....
Pittsfield, Berkshire County	.....	.....	.....	.....	.....
One mile from South Hadley, Hampshire County.	.....	.....	.....	.....	Once used as a resort.
West Medway, Norfolk County	.....	.....	.....	.....	.....
Springfield, Hampden County	.....	.....	.....	.....	.....
Five miles south of Williamstown, Berkshire County.	.....	.....	Temp. id. 46	Contains nitrogen gas.	.....
Near Mount Washington, Berkshire County.	.....	.....	.....	.....	.....
One or two miles south of Hinsdale, Berkshire County.	.....	.....	.....	Sulphureted.....	.....
Mineral Spring (pool), Shutesbury, Franklin County.	1	.....	.....	.....	Once used as a resort.
Mount Mineral Springs, Shutesbury, Franklin County.	3	.....	.....	.....	Do.
Sulphur Springs, two miles northeast of North Blandford, Hampden Co.	.....	.....	.....	.....	.....

*Analyses of mineral springs in Massachusetts.*

Constituents.	Allendale Spring.	Bethlehem Spring.	Echo Grove Mineral Spring.	
	Grains per gallon. <sup>a</sup>	Grains per gallon. <sup>b</sup>	Grains per gallon. <sup>c</sup>	Grains per gallon. <sup>d</sup>
Sodium carbonate.....	0.03	0.27	0.10	0.79
Sodium bicarbonate.....	0.40	0.55	0.76	1.43
Magnesium carbonate.....	0.70	0.60	1.38	4.27
Calcium carbonate.....	0.02	0.07		
Calcium bicarbonate.....	0.37	0.03		
Iron carbonate.....	0.15	0.33		
Lithium bicarbonate.....	0.37	0.14	0.41	0.07
Sodium sulphate.....	0.13	0.31	0.99	1.18
Potassium sulphate.....	0.38		0.37	0.67
Sodium chloride.....	0.57	0.52	Trace	Trace
Silicic acid in solution.....			Trace	No trace
Silica.....	0.29	0.27		
Iron.....	0.39	0.39		
Alumina.....				
Organic matter.....				
Water of hydration.....				
Total.....	3.30	3.48	4.01	8.41

Constituents.	Coldbrook Springs.		Everett Crystal Spring.	Commonwealth Spring.
	No. 1, sulphur spring.	No. 2, iron spring.		
	Grains per gallon. <sup>e</sup>	Grains per gallon. <sup>e</sup>	Parts per 1,000. <sup>f</sup>	Grains per gallon. <sup>c</sup>
Sodium bicarbonate.....				0.501
Magnesium bicarbonate.....				0.181
Calcium bicarbonate.....			0.0213	0.447
Potassium sulphate.....				0.611
Calcium sulphate.....			0.0350	
Nitrates.....			Trace	
Sodium chloride.....			0.0060	0.340
Magnesium chloride.....			0.0342	
Silicic acid in solution.....	1.27	1.11		0.370
Silica.....			0.0160	
Iron oxide.....	(g)	0.82		
Iron.....			Trace	} Trace
Alumina.....				
Lime.....	0.81			
Magnesia.....	0.26			
Potash and soda.....	1.48	0.50		
Chlorine.....	0.41			
Sulphur.....	} 0.70	0.22 {		
Sulphuric acid.....				
Ammonia.....	(g)			
Albuminoid ammonia.....			0.0001	
Orenic acid.....	2.20	1.20		
Organic matter.....	} 0.69	0.31 {		
Loss.....				
Water of hydration.....	24.28	16.64		
Volatile matter (on ignition).....			0.0530	
Total.....	31.60	20.80	0.1656	2.450

<sup>a</sup> William Ripley Nichols, analyst.<sup>b</sup> E. Cornell Esten, analyst (1885).<sup>c</sup> S. Dana Hayes, analyst (1879).<sup>d</sup> Charles R. Fletcher, analyst (1880).<sup>e</sup> A. A. Hayes, analyst.<sup>f</sup> Samuel Cabot, jr., analyst (1882).<sup>g</sup> Iron oxide, ammonia, loss, organic matter, all equal 0.69.<sup>h</sup> With free ammonia.

## RHODE ISLAND.

The record of mineral springs for Rhode Island is somewhat meager and so far as we can learn the springs are of comparatively little importance. It is said that, in connection with the spring near Pawtucket, there was in operation for a number of years an extensive water-cure and medical establishment.

There may possibly be a few springs in the State that have escaped notice, and if so the waters are likely to be somewhat chalybeate.

*Mineral springs of Rhode Island.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Cranston Mineral Spring, on Sockanosset Hill, Cranston Township, Providence County.	.....	.....	.....	Chalybeate .....	Unimproved.
Cumberland Spring, Cumberland Hill, Providence County.	.....	.....	.....	.....	.....
Darling's Mineral Springs, near Pawtucket, Providence County.	.....	.....	.....	Chalybeate and sulphureted.	Once a water cure and sanitarium.
Holly Spring, 2 miles east of Woonsocket, Providence County.	1	180	.....	Alkaline.....	Water is sold.
Ochee Springs, Johnson Township, 3 miles from Providence, Providence County.	12	500	45	Alkaline, calcic.	Water is bottled and sold.
Warwick Neck Mineral Springs, Warwick Neck, Kent County.	.....	.....	.....	Chalybeate .....	Unimproved.

*Analyses of mineral springs in Rhode Island.*

Constituents.	Ochee Springs.	Holly Spring.
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>
Calcium carbonate .....	3.198	0.43545
Magnesium carbonate .....	1.126	0.24516
Sodium sulphate .....	0.414	.....
Calcium sulphate .....	0.443	0.37125
Potassium sulphate .....	0.881	.....
Sodium chloride .....	0.566	0.34439
Potassium chloride .....	.....	Trace
Silica .....	.....	0.60707
Alumina .....	}	.....
Iron oxide .....		0.03619
Insoluble mineral matter .....	0.583	.....
Organic matter .....	}	.....
Volatile matter .....		0.46697
Undetermined .....	0.155	.....
Loss .....	.....	0.00352
Total .....	8.989	2.51000

<sup>a</sup> John K. Appleton, analyst (1880).<sup>b</sup> Edwin E. Calder, analyst (1883).

## CONNECTICUT.

The mineral springs of Connecticut are comparatively unimportant, at least in point of number, and, so far as known, they are feebly mineralized. They are mainly weak chalybeates, occurring under the same circumstances as do those of Massachusetts, in deposits of bog-iron ore or in connection with iron pyrites. Some are also feebly sulphureted. Although the majority are unimproved and but few are used commercially, many have considerable local reputation. Prof. C. W. Shepard in 1837 speaks of the springs at Stafford as being the most important in the State, and this is still the case. This locality is the only one given by Walton. Many of the places once resorted to are now abandoned. The present list is made up from Professor Shepard's report, supplemented by information acquired by correspondence with various persons in the State.

*Mineral springs of Connecticut.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Bald Hill Spring, Portland, Middlesex County.	.....	.....	.....	Chalybeate .....	Unimproved and unimportant.
<i>Chalybeate springs:</i>					
Cromwell, Middlesex County .....	.....	.....	.....	.....	Improved about 50 years ago; unimproved now.
Two miles east of South Kent, Litchfield County.	.....	.....	.....	.....	
Four miles west of Litchfield, Litchfield County.	.....	.....	.....	.....	
Collins Hill Spring, Portland, Middlesex County.	.....	.....	.....	.....	Unimproved and unimportant.
Holbrook Mineral Spring, Lebanon, New London County.	.....	.....	.....	Sulphureted .....	Improved 15 years ago.
Kenyon's Mill Spring, Colchester, New London County.	.....	.....	.....	.....	Used locally.
Mineral Springs, North Woodstock, Windham County.	4	.....	.....	Sulphureted chalybeate, &c.	Once a resort.
Oxford Spring, Oxford, New Haven County.	.....	.....	.....	Chalybeate .....	Used commercially.
The Pool, North Haven, New Haven County.	1	480	50	do .....	Has local reputation.
The Pool, Salisbury, Litchfield County.	1	.....	.....	.....	Once had a local reputation.
The Pool, Suffield, Hartford County...	1	.....	.....	Sulphureted .....	Was a resort 30 years ago; has local reputation.
Stafford Springs, Stafford Springs, Tolland County.	} 2	55+	{ <sup>34</sup> to <sup>46</sup> }	Chalybeate .....	{Resort; most important in the State.
Stark Mineral Spring, Bozrah, New London County.	1	200	46	Saline .....	Used commercially and as a resort.
Strong's Mill Spring, Colchester, New London County.	1	.....	.....	Chalybeate and sulphureted.	Has local reputation.
Sulphur Spring, Nepaug, Litchfield County.	1	.....	.....	.....	Unimproved.

*Analyses of mineral springs in Connecticut.*

Constituents.	Oxford Spring.	Stark Mineral Spring.
	<i>Grs. per gall. <sup>a</sup></i>	<i>Grs. per gall. <sup>b</sup></i>
Sodium bicarbonate.....		0.29
Potassium bicarbonate.....		0.10
Magnesium bicarbonate.....		0.33
Calcium bicarbonate.....		1.23
Iron carbonate.....	0.91	
Iron bicarbonate.....		0.06
Sodium sulphate.....	0.49	0.18
Potassium sulphate.....	Trace	
Lithium sulphate.....	Trace	
Magnesium sulphate.....	0.62	
Calcium sulphate.....	1.16	
Sodium chloride.....	0.34	0.33
Silicio acid.....		0.85
Silica and insoluble matter.....	1.33	
Organic matter.....	1.27	
Loss.....	0.10	
Total.....	6.22	3.37

<sup>a</sup> George F. Barker, analyst (1873).<sup>b</sup> S. W. Johnson, analyst (1880).

## NEW YORK.

New York is distinguished among her sister States for the number of her mineral springs. On the list she is credited with a greater number of localities than any other State, which may be due to the fact that attention has been more drawn to the subject of mineral springs in New York than in most other States, probably on account of the commercial success of the Saratoga Springs. It is due also, in part, to the fact that the springs have been pretty thoroughly studied and so many of them subjected to chemical examination. The list given by Professor Beck in Vol. III of the New York Geological Reports was very complete for the State at the time it was published (1842). Since then many springs have been discovered. Some considered unimportant at that time have since been developed, while others used as resorts have been abandoned. The springs are of great variety. The majority of them are sulphureted. As to the solid mineral contents, saline and chalybeate springs predominate. The highest temperature reached by any of the springs is at Lebanon, where the thermal spring attains 75° F. Several of the springs at Saratoga and Ballston have temperatures that exceed the mean annual temperatures of those places, and are, therefore, in a strict sense, thermal springs.

Another point of interest in relation to the New York mineral springs is the occurrence of springs containing free sulphuric acid, as springs of this class are somewhat rare. The most celebrated spring of this class in New York is probably the Oak Orchard spring.

The Saratoga Springs are the most widely known of American springs and have many namesakes in all parts of the United States, being in all probability the first mineral springs of the country to be improved as a place of resort, the first hotel for the accommodation of visitors having been opened there in 1774.

*Mineral springs of New York.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Adirondack Mineral Springs, Whitehall, Washington County.	2	200	38	Chalybeate .....	Used commercially.
Albany Artesian Well (500 feet), Albany, Albany County.	1	.....	.....	Saline .....	
Auburn Spring, 4 miles west of Auburn, Cayuga County.	1	.....	.....	Sulphureted .....	Has a local reputation and is sold to small extent.
Avon Sulphur Springs, Avon, Livingston County.	4	7,660	50	.....do .....	Used commercially and as a resort.
Ballston Spa Springs, Ballston, Saratoga County.	.....	.....	.....	.....	Resort.
Artesian Lithia Spring .....	1	5	52	Saline .....	Used commercially.
Franklin Spring .....	1	.....	52	.....do .....	
Iron Spring .....	1	4,000	.....	.....do .....	
Sans Souci Spring .....	1	.....	.....	.....do .....	
United States Spring .....	1	.....	50	.....do .....	
Washington Lithia Well .....	1	.....	49	.....do .....	Do.
Barton Sulphur Spring, near Waverly, Tioga County.	.....	.....	.....	.....	
Byron Acid Spring, Byron, Genesee Co.	.....	.....	.....	Acid .....	
Cairo White Sulphur Springs, Cairo, Greene County.	.....	.....	.....	Sulphureted .....	Resort.
<i>Calcic springs:</i>					
Near Sempronius, Cayuga County.	.....	.....	.....	.....	
Near Chateaugay, Franklin County.	.....	.....	.....	.....	
On Otseguago Creek, Stark Township, Herkimer County.	.....	.....	.....	.....	
Near Starkville, Herkimer County.	.....	.....	.....	.....	
At Caledonia, Livingston County.	.....	.....	.....	.....	
Near Cartersville, Monroe County.	.....	.....	.....	.....	Unimproved.
In southwestern part of Wheatland Township, Monroe County.	.....	.....	.....	.....	Do.
In Cather's Cave, near Niagara Falls, Niagara County.	.....	.....	.....	.....	
Near Syracuse, Onondaga County.	.....	.....	.....	.....	
At Manlius Centre, Onondaga County.	.....	.....	.....	.....	
At Onondaga, Onondaga County.	.....	.....	.....	.....	
North of Otisco Lake outlet, Onondaga County.	.....	.....	.....	.....	
At Schoharie, Schoharie County.	.....	.....	.....	.....	
Four miles northwest of Gouverneur, Saint Lawrence County.	.....	.....	.....	.....	
Near Ithaca, Tompkins County.	.....	.....	.....	.....	
In Washington County.	.....	.....	.....	.....	
Canoga Springs, Canoga, Seneca Co.	.....	.....	.....	.....	
Cayuga Mineral Spring, 2½ miles north of Cayuga, Cayuga County.	1	50	.....	.....	Used commercially.
<i>Chalybeate springs:</i>					
Five miles northwest of Auburn, Cayuga County.	.....	.....	.....	.....	Used locally for medicinal purposes.
Four or five miles from West Troy, Albany County.	.....	.....	.....	.....	
South of Canaan Centre, Columbia County.	.....	.....	.....	.....	
Livingston, Columbia County.	.....	.....	.....	.....	
Near Sidney Plains, Delaware Co.	.....	.....	.....	.....	
Two miles from Bloomville, Delaware County.	.....	.....	.....	.....	
Three miles above Walton, Delaware County.	.....	.....	.....	.....	
Near Upton Pond, Dutchess County.	.....	.....	.....	.....	
Near Kline's Corners, Dutchess Co.	.....	.....	.....	.....	
Near Williamsville, Erie County.	.....	.....	.....	.....	
Two miles north of Elba, Genesee County.	.....	.....	.....	.....	
North part of Warren Township, Herkimer County.	.....	.....	.....	.....	
Bethel, in Stark Township, Herkimer County.	.....	.....	.....	.....	
South part of Pittsford Township, Monroe County.	.....	.....	.....	.....	Unimproved.

*Mineral springs of New York—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fabr.	Character of the water.	Remarks.
<i>Chalybeate springs—Continued.</i>					
Near Lewiston, Niagara County.....	.....	.....	o	.....	.....
Van Buren Township, Onondaga Co.....	.....	.....	.....	.....	.....
Near West Point, Orange County.....	.....	.....	.....	.....	.....
Shawangunk Mt., Orange County.....	.....	.....	.....	.....	.....
Near Sand Lake, Rensselaer Co.....	.....	.....	.....	.....	.....
In Richmond County.....	.....	.....	.....	.....	.....
Between West Neck and Lloyd's Neck, Suffolk County.....	.....	.....	.....	.....	.....
Near North Blenheim, Schoharie Co.....	.....	.....	.....	.....	.....
In Steuben County.....	.....	.....	.....	.....	.....
Three miles from Sag Harbor, Suffolk County.....	.....	.....	.....	.....	.....
Horton's Point, Suffolk County.....	.....	.....	.....	.....	Small and unimportant.
Hudson's Point, Riverhead, Suffolk County.....	.....	.....	.....	.....	.....
East Hampton, Suffolk County.....	.....	.....	.....	.....	.....
At Little Cow Harbor, Suffolk Co.....	.....	.....	.....	.....	Unimportant.
At North Salem, Westchester Co.....	.....	.....	.....	.....	.....
Chappaqua Spring, Chappaqua, Westchester County.....	.....	.....	.....	.....	.....
Cherry Valley Phosphate Spring, Cherry Valley, Otsego County.....	1	10	.....	.....	Not used at present.
Cherry Valley Springs, Cherry Valley, Otsego County.....	2	.....	.....	Sulphureted.....	.....
Chittenango White Sulphur Springs, Chittenango, Madison County.....	3	.....	49½	.....do.....	Resort.
Chlorine Springs, Syracuse, Onondaga County.....	5	2,000	49	Saline.....	Used commercially and as a resort.
Clifton Springs, Clifton Springs, Ontario County.....	3+	.....	54	Sulphureted.....	Resort.
Clinton Spring, Cliff street, New York, New York County.....	.....	.....	.....	.....	.....
Columbia White Sulphur Springs, 4 miles north of Hudson, Columbia Co.....	4	.....	55	Saline, sulphureted.....	Do.
Crystal Springs, Crystal Spring, Yates County.....	6	1,250+	48	.....	Do.
Dansville Springs, Dansville, Livingston County.....	4	1,000	.....	Alkaline, calcic.....	Sanitarium and resort.
Darien Mineral Spring, Darien Centre, Genesee County.....	1	40 f	.....	Acid.....	Used commercially.
Darrow Spring, south of Baldwinsville, Onondaga County.....	1	.....	.....	Calcic, sulphur.....	Has a local reputation.
Deep Rock Springs, Oswego, Oswego County.....	2	.....	50	Sulphureted, saline.....	Used commercially and as a resort.
Diamond Rock Mineral Well, Williamson, Wayne County.....	1	30	44	Sulpho-saline.....	Do.
Doxtatter's Mineral Well (Longmuir's Well), Rochester, Monroe County.....	1	.....	52	Saline, sulphureted.....	Used for bathing.
Dryden Springs, half mile west of Dryden, Tompkins County.....	.....	.....	(48) to (54)	Chalybeate and sulphureted, saline.....	Resort.
Elkhorn Springs, north of Maunius Village, Onondaga County.....	3	.....	50	Saline, sulphureted.....	Local resort.
Excelsior Spring, Syracuse, Onondaga County.....	1	1,000	48	Saline.....	Used commercially and as a resort.
Fairport Mineral Springs, Fairport, Monroe County.....	2	.....	.....	Sulphureted, &c.....	Has a local reputation.
Florida Springs, Florida Township, Montgomery County.....	2	.....	43	Sulphureted.....	Local resort.
Franklin Springs, Cowlesville, Wyoming County.....	1	.....	40	.....	Resort.
Grove Springs, near Hammondsport, Steuben County.....	.....	.....	.....	.....	.....
Halleck's Spring, near Westmoreland, Oneida County.....	1	.....	.....	Saline.....	Was improved and used as a resort about 1838 to 1840, but is now unimproved.
Harrowgate Springs, Rensselaer County, 3 miles from Albany.....	.....	.....	.....	Sulphureted.....	.....
Kingsley Springs, near Marion, Wayne County.....	3	.....	40	Saline f.....	Unimproved.
Lebanon Thermal Spring, Lebanon Springs, Columbia County.....	1	30,000	75	Chalybeate.....	Used commercially and as a resort.

*Mineral springs of New York—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Lockport Mineral Spring, $1\frac{1}{2}$ miles north of Lockport, Niagara County.	.....	.....	.....	Saline .....	Unimproved, but used by residents of Lockport.
Madrid Springs, Madrid Springs, Saint Lawrence County.	.....	.....	.....	.....	Unimproved at present.
Massena or Saint Regis Springs, Massena, Saint Lawrence County.	2	700+	45	Saline, sulphureted.	Used commercially and as a resort.
Messena Sulphur Springs, 3 miles east of Syracuse, Onondaga County.	3	5	50	Sulphureted .....	.....
Mineral Springs, $1\frac{1}{2}$ miles northwest of Cayuga, Cayuga County.	.....	.....	.....	.....	Has local reputation and is sold.
Mineral Springs, Mineral Springs, Schoharie County.	2	120	44	.....	Unimproved at present; was once a resort.
<i>Mineral springs:</i> At Watervleit Centre, Albany County.	.....	.....	.....	Sulphureted, chalybeate, carbonated.	.....
At Montezuma, Cayuga County.	.....	.....	.....	Saline .....	Unimportant.
Near Crown Point, Essex County.	.....	.....	.....	do .....	.....
Northwestern part of Columbia Township, Herkimer County.	.....	.....	.....	.....	.....
Two miles northeast of Pittsford, Monroe County.	.....	.....	.....	Saline, sulphureted.	Sold to some extent.
North of Elbridge, Onondaga Co.	1	.....	.....	Saline?	Unimproved.
At Quaker Springs, Saratoga Co.	.....	.....	.....	Sulphureted .....	Do.
Monroe Springs, 5 miles from Rochester, Monroe County.	.....	.....	.....	do .....	.....
Nanticoke Sulphur Springs, near Lamb's Corners, Broome County.	.....	.....	.....	.....	.....
Nunda Mineral Springs, Nunda, Livingston County.	3	30	.....	Saline .....	Resort and water is sold.
Oak Orchard Acid Springs, Alabama, Genesee County.	8	.....	.....	Acid and chalybeate.	Used commercially.
Pitcher Springs, Pitcher Springs, Chenango County.	.....	.....	.....	Sulphureted .....	.....
Pittsford Sulphur Springs, Olcott's farm, northwest part of Pittsford Township, Monroe County.	.....	.....	.....	do .....	Once a resort.
Reid's Mineral Spring, South Argyle, Washington County.	1	8	.....	Carbonated, saline.	Local resort.
Richfield Springs, Richfield Springs, Otsego County.	3	.....	47	Sulphureted, chalybeate, and saline.	Resort.
Riga Mineral Springs, Riga, Monroe County.	.....	.....	.....	Carbonated, chalybeate.	.....
Sauquoit Sulphur Spring, near Sauquoit, Oneida County.	1	4	.....	Saline .....	Unimproved.
Saratoga Springs, Saratoga County	.....	.....	.....	.....	Resort.
Champion Spring	1	2,500	49	Saline carbonated	Used commercially.
Columbian Springs	4	.....	55	do .....	Do.
Congress Spring	.....	.....	51	do .....	Do.
Crystal Springs	6	129	.....	.....	.....
Ellis Spring	1	.....	.....	.....	Surface spring.
Empire Spring	.....	.....	.....	Saline carbonated	Used commercially.
Eureka Spring	.....	.....	.....	.....	Not in general use at present.
Excelsior Spring	1	33	45	Saline carbonated	Used commercially.
Flat Rock Spring	.....	.....	.....	do .....	.....
Geyser Springs	3	900+	46	do .....	Do.
Hamilton Spring	.....	.....	49 $\frac{1}{2}$	.....	.....
Hathorn Spring	.....	.....	.....	Saline carbonated	Do.
High Rock and Apollis Springs	2	1,000	.....	do .....	Do.
Indian Encampment Spring	.....	.....	.....	.....	Abandoned.
Lake Sulphur Spring	.....	.....	.....	.....	.....
Minnehaha Spring	.....	.....	.....	.....	.....
Monroe Spring	.....	.....	.....	.....	.....
Old Red Spring	1	60	.....	Saline carbonated	Used commercially.
Pavilion Spring	1	12,000	50	do .....	Not used commercially at present.
Putnam Springs	2	24	40	do .....	Used commercially.
Saratoga A (or alum) Spring	.....	.....	.....	.....	.....
Saratoga Seltzer Spring	1	.....	50	Saline carbonated.	Not used commercially at present.

*Mineral springs of New York—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Saratoga spings—Continued.					
Star Spring (formerly Walton or Iodine Spring).	1	80	50	Saline, carbonated.	Used commercially.
Triton Spring (Kissingen) .....					Do.
Union Spring .....	1	12	48	Saline, carbonated.	Do.
United States Spring .....					
Vichy Spring .....	1	240	50	Alkaline, saline, carbonated.	Do.
Walton Spring (same as Star) .....					
Washington Spring .....			45	Carbonated saline.	Do.
White Sulphur Springs .....	2	2,400+	48	Sulphureted .....	Used for bathing.
Seneca Spa or Deer Lick Springs, 4 miles east of Buffalo, Erie County.					
Sharon Springs, Sharon Springs, Schoharie County.	5	7,680+	48	Alkaline and saline, sulphureted.	Used commercially and as a resort.
Shee's Spa, McDonough Township, Chenango County.				Sulphureted .....	
Slaterville Magnetic Springs, Slaterville, Tompkins County.	27	2,700 ?	47		Do.
Spencer Springs, Spencer, Tioga Co ..					
<i>Sulphur springs:</i>					
At Wendell's Hollow, near Albany, Albany County.					
At Coeymans, Albany County .....					
At Guilderland, Albany County .....					
Four miles west of Rensselaerville, Albany County.					
Two miles west of Auburn, Cayuga County.					Unimproved.
One and one-half miles north of Auburn, Cayuga County.					Do.
Two miles north of Union Springs, Cayuga County.	2				
Near Randolph, Cattaraugus Co .....					
Near Van Buren Harbor, Chautauqua County.					
Near Fredonia, Chautauqua Co .....					
Near Sheridan, Chautauqua Co .....					
Near Laona, Chautauqua County .....					Do.
Two miles from Norwich, Chenango County.					
Near Pharsalia, Chenango County.					
Near Beekmantown, Clinton Co .....					
Near Kinderhook, Columbia Co .....					Do.
Near Millers, in Claverack Township, Columbia County.					Unimportant.
At Oakhill, near Catskill, Columbia County.					Unimproved.
At Preble, Cortland County .....					
Three miles from Chehocton, Delaware County.					
Near Amenia, Dutchess County .....					Do.
At Grand Island, Erie County .....					
In Amherst Township, Erie County					
Clarence Township, Erie County .....					
One and one-half miles west of Durham, Greene County.					Do.
One mile from Catskill, Greene Co					Do.
Three-fourths mile west of Athens, Greene County.					
Four miles west of Athens, Greene County.					
Near Richfield Springs, Warren Township, Herkimer County.	6				Used locally.
Near Starkville, Herkimer Co .....					
Near Winfield, Herkimer Co .....					
In Danube Township, Herkimer Co.					
At Mohawk, Herkimer County .....					
Near Newville, Herkimer County .....					
Near Martinsburgh, Lewis County ..					
At Caledonia, Livingston County ..					

Mineral springs of New York—Continued.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fabr.	Character of the water.	Remarks.
<i>Sulphur springs—Continued.</i>					
One-half mile south of Spencerport, Monroe County.	.....	.....	o	.....	.....
In Gates Township, Monroe County	.....	.....	.....	.....	.....
In Mendon Township, Monroe Co.	.....	.....	.....	.....	.....
At Ogden, Monroe County	.....	.....	.....	.....	.....
In Deep Hollow Valley, northwest- ern part of Rochester, Monroe Co.	.....	.....	.....	.....	Used locally.
In Niagara County, two miles from Tonawanda.	.....	.....	.....	.....	.....
Near Niagara Falls, Niagara Co.	.....	.....	.....	.....	.....
Above Lewiston, Niagara County	.....	.....	.....	.....	.....
North part of Pendleton Township, Niagara County.	.....	.....	.....	.....	.....
In Augusta, Oneida County	.....	.....	.....	.....	.....
Near Vernon, Oneida County	.....	.....	.....	.....	.....
Near Paris, Oneida County	.....	.....	.....	.....	.....
West of Elbridge, Onondaga Co.	.....	.....	.....	.....	.....
South of Manlius Village, Onon- daga County.	.....	.....	.....	.....	.....
In Caruthers (?) Twp., Onondaga Co.	.....	.....	.....	.....	.....
Near Syracuse, Onondaga County	.....	.....	.....	.....	.....
Near Split Rock, Onondaga County	.....	.....	.....	.....	.....
Lake Sodom, near Manlius Centre, Onondaga County.	.....	.....	.....	.....	.....
In La Fayette Twp., Onondaga Co.	.....	.....	.....	.....	Used locally for medic- inal purposes.
At outlet of Canandaigua Lake, Ontario County.	.....	.....	.....	.....	.....
Two and one-half miles from New- burgh, Orange County.	.....	.....	.....	.....	.....
In New Windsor Twp., Orange Co.	.....	.....	.....	.....	.....
In Holley, Orleans County	2	.....	.....	.....	Weak and unimportant.
North end of Troy, Rensselaer Co.	.....	.....	.....	.....	.....
Near Bath, Rensselaer County	.....	.....	.....	.....	.....
Near Waterloo, Seneca County	.....	.....	.....	.....	.....
Near Campbell, Steuben County	1	.....	.....	.....	Unimportant.
At Jasper, Steuben County	10	.....	.....	.....	.....
Near Hammondsport, Steuben Co.	.....	.....	.....	.....	.....
Two and one-half miles southwest of Sag Harbor, Suffolk County.	.....	.....	.....	.....	.....
At Tioga Centre, Tioga County	.....	.....	.....	.....	.....
West of Springtown, Ulster County	.....	.....	.....	.....	.....
Two miles southeast of Ithaca, Tompkins County.	.....	.....	.....	.....	.....
Near Newark, Wayne County	.....	.....	.....	.....	Do.
Near Palmyra, Wayne County	.....	.....	.....	.....	Do.
In Sodus Township, Wayne Co	.....	.....	.....	.....	.....
At Clyde, Wayne County	3	.....	.....	.....	Do.
Near Marion, Wayne County	4	.....	.....	.....	Only one spring util- ized.
Sulphur well, Peterson's farm, north- west of Rochester, Monroe County.	.....	.....	.....	.....	Unimproved.
<i>Sulphuric acid springs:</i>					
North part of Alabama Township, Genesee County.	.....	.....	.....	.....	.....
In Elba Township, Genesee Co	.....	.....	.....	.....	.....
Near South Byron, Genesee Co.	.....	.....	.....	.....	.....
Union Springs, Union Springs, Ca- yuga County.	2	10	.....	Sulphureted and chalybeate.	Do.
Vallonia Springs, Vallonia Springs, Broome County.	.....	.....	.....	.....	.....
Verona Mineral Springs, near Verona, Oneida County.	4	160+	48	Saline	Used to some extent commercially and as a resort.
Victor Spring, Darien Centre, Genesee County.	1	40	.....	Acid saline	Used commercially.
Yates Sulphur Springs, 1 mile south of Chittenango, Madison County.	.....	.....	.....	.....	.....
Yellow Spring, Southampton (Long Island), Suffolk County.	.....	.....	.....	Chalybeate	Unimportant.

*Analyses of mineral springs in New York.*

Constituents.	Adirondack Spring.	Albany Artesian Well.		Auburn Spring, West Auburn.
<i>Solids.</i>	<i>Grains per gall.<sup>a</sup></i>	<i>Grains per gall.<sup>b</sup></i>	<i>Grains per gall.<sup>c</sup></i>	<i>Grains per gall.<sup>d</sup></i>
Sodium carbonate .....	5.14	40.00	40.00	.....
Potassium carbonate .....	5.32	.....	.....	.....
Calcium carbonate .....	18.54	32.00	32.00	.....
Magnesium carbonate .....	16.62	16.00	12.00	.....
Lithium carbonate .....	0.02	.....	.....	.....
Manganese carbonate .....	Trace	.....	.....	.....
Iron carbonate .....	5.04	8.00	8.00	.....
Calcium sulphate .....	11.13	.....	.....	120.00
Magnesium sulphate .....	.....	.....	.....	25.60
Sodium chloride .....	14.34	504.00	472.00	6.00
Calcium chloride .....	.....	.....	4.00	.....
Magnesium chloride .....	.....	.....	.....	2.00
Alumina .....	Trace	.....	.....	.....
Silica .....	0.74	.....	.....	.....
Total .....	76.89	600.00	568.00	153.60
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Sulphureted hydrogen .....	.....	.....	.....	12.00
Carbonic acid .....	67.27	184.00	.....	.....
Total .....	67.27	184.00	208.00	12.00

Constituents.	Avon Sulphur Springs.			
	Upper Spring. <sup>f</sup>	Lower Spring.	New Bath Spring.	Congress Hall Spring.
<i>Solids.</i>	<i>Grains per gall.<sup>g</sup></i>	<i>Grains per gall.<sup>d</sup></i>	<i>Grains per gall.<sup>c</sup></i>	<i>Grains per gall.<sup>b</sup></i>
Calcium carbonate .....	8.00	29.33	26.96	9.25
Sodium sulphate .....	16.00	13.73	38.72	21.02
Calcium sulphate .....	84.00	57.44	3.52	27.61
Magnesium sulphate .....	10.00	49.61	8.08	19.07
Sodium chloride .....	18.40	.....	5.68	29.11
Calcium chloride .....	.....	8.41	.....	.....
Sodium iodide .....	.....	Trace <sup>i</sup>	.....	.....
Sodium sulphide .....	.....	.....	.....	.....
Calcium sulphide .....	.....	.....	.....	99.55
Magnesium sulphide .....	.....	.....	.....	.....
Total .....	136.40	158.52	82.96	205.61
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Sulphureted hydrogen .....	12.00	10.02	31.28	27.63
Carbonic acid .....	5.60	3.92	.....	22.04
Oxygen .....	.....	0.56	.....	0.97
Nitrogen .....	.....	5.42	.....	3.68
Total .....	17.60	19.92	.....	54.52

<sup>a</sup> C. Collier, analyst.<sup>b</sup> Wm. Meade, analyst (1827).<sup>c</sup> L. C. Beck, analyst (1842).<sup>d</sup> J. R. Chilton, analyst.<sup>e</sup> With silica.<sup>f</sup> Same as Middle Spring of Beck's report<sup>g</sup> J. Hadley, analyst.<sup>b</sup> H. M. Baker, analyst (1874).<sup>i</sup> Contains iodine and bromine.

Analyses of mineral springs in New York—Continued.

Constituents.	Ballston Spa Springs.				
	Sans Souci Spring.	Artesian Lithia Spring.	Franklin Artesian Well.	United States.	Washington Lithia well. (Old Conde Dentonian.)
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>e</sup></i>
Sodium carbonate.....	12.66			16.88	
Sodium bicarbonate.....		11.93	94.60		34.40
Calcium carbonate.....	43.41			29.20	
Calcium bicarbonate.....		238.16	202.33		173.48
Magnesium carbonate.....				5.76	
Magnesium bicarbonate.....	39.10	180.60	177.87		158.35
Strontium bicarbonate.....		0.87	Trace		0.19
Lithium bicarbonate.....		7.75	6.78		15.51
Iron carbonate.....	5.95				
Iron bicarbonate.....		1.58	1.61		2.30
Barium bicarbonate.....		3.88	1.23		4.74
Sodium sulphate.....				1.76	
Potassium sulphate.....		0.52	0.76		
Sodium phosphate.....		0.05	0.01		Trace
Sodium biphosphate.....		Trace	Trace		Trace
Sodium chloride.....	143.73	750.03	659.34	424.96	645.48
Potassium chloride.....		33.28	33.93		9.23
Sodium bromide.....		3.64	4.67		2.37
Calcium fluoride.....		Trace	Trace		Trace
Sodium iodide.....	1.30	0.12	0.24		0.22
Alumina.....		0.08	0.26		0.40
Silica.....	1.00	0.76	0.74	8.00	1.03
Organic matter.....		Trace	Trace		Trace
Total.....	247.15	1,233.25	1,184.37	486.56	1,047.70
<i>Gases.</i>					
Carbonic acid.....		426.114	460.066	244.00	358.345

Constituents.	Chittenango Springs.			Clifton Springs: Sulphur Spring.	Columbia White Sulphur Springs.
	White Sulphur Spring.	Cave Spring.	Magnesia Spring.		
<i>Solids.</i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>s</sup></i>	<i>Grains per gallon.<sup>h</sup></i>
Calcium carbonate.....				9.68	21.79
Magnesium carbonate.....				13.12	
Magnesium bicarbonate.....	22.02	23.97			
Iron carbonate.....			20.78		
Iron bicarbonate.....	0.08	0.16	0.32		
Sodium hyposulphite.....		0.26	0.02		8.15
Sodium sulphate.....	0.21			7.76	
Calcium sulphate.....	81.42	106.12	115.09	69.20	64.94
Strontium sulphate.....	Trace	Trace	Trace		
Magnesium sulphate.....	1.95	7.59	12.72	16.48	
Sodium phosphate.....					2.14
Sodium chloride.....	1.04	1.57	1.83	9.28	84.72
Calcium chloride.....				4.08	
Potassium chloride.....	0.16	0.23	0.33		1.19
Magnesium chloride.....				4.08	31.43
Lithium chloride.....	Trace	Trace	Trace		
Iron sesquichloride.....					3.42
Sodium sulphide.....	0.12	0.39	0.75		
Calcium sulphide.....		1.12	0.93		
Alumina.....	0.08	0.22	Trace		
Silica.....	0.28	0.52	0.58		
Sulphur.....	Trace				
Loss.....					0.82
Organic matter.....				Trace	
Total.....	107.36	142.15	153.35	133.63	218.60
<i>Gases.</i>					
Sulphureted hydrogen...	<i>Cubic inches.</i> 0.884	<i>Cubic inches.</i> 2.754	<i>Cubic inches.</i> 5.623	<i>Cubic inches.</i> Present	<i>Cubic inches.</i> 4.491
Carbonic acid.....	20.480	15.934	19.436	Present	

<sup>a</sup> John H. Steele, analyst (1830).

<sup>b</sup> C. F. Chandler, analyst (1868).

<sup>c</sup> C. F. Chandler, analyst.

<sup>d</sup> L. C. Beck, analyst.

<sup>e</sup> C. F. Chandler, analyst (1869).

<sup>f</sup> With iron oxide.

<sup>g</sup> J. R. Chilton, analyst (1852).

<sup>h</sup> Atwood, analyst.

*Analyses of mineral springs in New York—Continued.*

Constituents.	Barton Sulphur Springs.	Cherry Valley Springs.		
		Bath-House Spring.	Spring north of bath-house.	Phosphate Spring.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Sodium carbonate.....	11.12			
Calcium carbonate.....	3.65	9.41	14.75	2.87
Magnesium carbonate.....	1.99	17.82	9.96	4.58
Iron carbonate.....			2.45	0.62
Ammonium carbonate.....	6.95			
Sodium sulphate.....		11.08		
Calcium sulphate.....	0.20	57.68	149.46	5.27
Magnesium sulphate.....		24.56		
Calcium phosphate.....				13.77
Sodium chloride.....	2.05	12.44	2.13	0.47
Calcium chloride.....		2.80		
Potassium chloride.....	0.11		2.49	
Magnesium chloride.....		3.68		
Calcium sulphide.....		0.60		
Iron oxide.....	} 0.36	} 0.36		
Alumina.....				
Silica.....			3.64	0.62
Sulphur.....	1.52			
Organic matter.....		0.28		
Carbonic acid.....	2.62			
Total.....	31.73	140.71	184.88	28.20
<i>Gases.</i>				
Oxygen.....	0.20			

  

Constituents.	Cherry Valley Springs.	Yates Sulphur Springs.	Doxtatter's, or Long-muir's Well, Rochester.	Verona Mineral Springs.
	Phosphate Spring.			
<i>Solids.</i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>e</sup></i>	<i>Grains per gallon.<sup>e</sup></i>	<i>Grains per imp. gall.<sup>f</sup></i>
Calcium carbonate.....		7.04	£11.84	38.47
Magnesium bicarbonate.....	17.27			
Manganese bicarbonate.....	0.01			
Iron bicarbonate.....	0.20			
Sodium sulphate.....	0.04	13.28	55.92	
Calcium sulphate.....	41.13	} 102.00		63.19
Magnesium sulphate.....	0.47			
Potassium sulphate.....	0.46			
Strontium sulphate.....	Trace			
Lithium sulphate.....	0.02			
Barium sulphate.....	0.01			
Calcium phosphate (acid).....	0.60			
Sodium bichlorate.....	Trace			
Sodium nitrate.....	Trace			
Sodium chloride.....	0.68	1.12		562.89
Calcium chloride.....			52.16	82.61
Potassium chloride.....				4.06
Magnesium chloride.....				27.11
Lithium chloride.....				2.37
Sodium bromide.....	Trace			
Alumina.....	0.14			
Silica.....	0.29			0.59
Organic matter.....	Trace	Trace		
Total.....	61.32	123.44	119.92	781.29
<i>Gases.</i>				
Sulphureted hydrogen.....	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbonic acid.....			17.28	
			Trace	

<sup>a</sup> F. F. Thomas, analyst.<sup>b</sup> J. R. Chilton, analyst.<sup>c</sup> Perkins, analyst.<sup>d</sup> C. F. Chandler, analyst (1876).<sup>e</sup> L. C. Beck, analyst (1842).<sup>f</sup> Peter Collier, analyst (1870).<sup>g</sup> With magnesium carbonate and iron oxide.

## Analyses of mineral springs in New York—Continued.

Constituents.	Crystal Springs.	Deep Rock Mineral Spring.	Florida Spring.	Halleck's Spring.
	<i>Parts in 100.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>
Sodium bicarbonate.....		18.19	22.14	
Calcium carbonate.....			8.32	
Calcium bicarbonate.....			6.97	
Magnesium bicarbonate.....			0.71	
Sodium hyposulphate.....				40.00
Calcium sulphate.....			1.39	
Potassium sulphate.....		308.18	5.88	624.00
Sodium chloride.....				104.00
Calcium chloride.....		149.08		
Potassium chloride.....		10.25		32.00
Magnesium chloride.....			0.18	
Iron sulphide.....			2.01	
Sodium sulphide.....				
Magnesia.....	.003			
Lime.....	.008			
Iron oxide.....	.001	Trace		
Alumina.....	Trace		Trace	
Silica.....	Trace	71.70	0.79	
Soda.....	.001			
Chlorine.....	.003			
Iodine and phosphoric acid.....	Trace			
Carbonic acid (combined).....	.012			
Sulphuric acid.....	.001	Trace		
Loss.....		1.78		
Total.....	0.029	559.18	48.39	800.00
<i>Gases.</i>				
Carbureted hydrogen.....	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Sulphureted hydrogen.....	Trace		3.765	Trace
Carbonic acid.....	Trace	Undetermined	32.169	Trace

Constituents.	Lebanon Thermal Spring.	Nunda Mineral Springs.	Chlorine Spring.	Excelsior Spring.	Lockport Mineral Spring.
	<i>Grains per gallon.<sup>e</sup></i>	<i>Grains per gallon.<sup>f</sup></i>	<i>Grains per gallon.<sup>g</sup></i>	<i>Grains per gallon.<sup>h</sup></i>	<i>Grains per gallon.<sup>b</sup></i>
Sodium carbonate.....	2.41				
Calcium carbonate.....	4.04	104.10	22.38	15.24	9.27
Iron carbonate.....		1.05			
Calcium sulphate.....		184.41	38.63	36.45	5.72
Potassium sulphate.....	1.04				
Magnesium sulphate.....	1.06	203.58			
Sodium chloride.....	0.96	6.82	646.42	584.53	111.42
Sodium sulphide.....	0.02				
Iron oxide.....	0.94		Present		
Alumina.....	0.45	Trace			0.05
Silica.....	3.25	000.12	0.29	1.02	0.90
Organic matter.....	10.21				Trace
Magnesium carbonate.....					3.21
Sodium sulphate.....			26.28	13.16	
Calcium chloride.....					45.08
Potassium chloride.....					3.52
Magnesium chloride.....			17.86	17.69	11.04
Magnesium bromide.....				0.15	
Sodium bromide.....					1.57
Sodium iodide.....					2.36
Free carbonic acid.....			Present	Present	
Total.....	24.38	500.08	751.86	668.24	194.14
<i>Gases.</i>					
Sulphureted hydrogen.....	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbonic acid.....	0.48				2.86
Oxygen.....	2.00				5.79
Nitrogen.....	3.52				

<sup>a</sup> J. Fowler, analyst (1880).<sup>b</sup> S. H. Douglas, analyst (1871).<sup>c</sup> C. F. Chandler, analyst (1870).<sup>d</sup> J. Noyes, analyst.<sup>e</sup> H. Dussance, analyst.<sup>f</sup> S. A. Lattimore, analyst (1878).<sup>g</sup> Charles A. Goessman, analyst (1868).<sup>h</sup> J. Hadley, analyst (1861).

*Analyses of mineral springs in New York—Continued.*

Constituents.	Sharon Springs.				
	White Sulphur Spring.	Magnesia Spring.	Red Sulphur Spring.	Gardner Magnesia Spring.	Eye-Water Spring.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>a</sup></i>
Sodium bicarbonate.....	.....	.....	0.49	0.54	.....
Calcium bicarbonate.....	.....	.....	12.93	9.70	.....
Magnesium bicarbonate.....	24.00	30.50	0.69	1.36	32.00
Calcium sulphate.....	85.40	76.00	96.64	93.50	77.50
Magnesium sulphate.....	34.00	22.70	18.96	19.68	7.50
Sodium chloride.....	} 2.70	} 3.00	0.33	1.23	} 2.50
Magnesium chloride.....			0.73	0.44	
Calcium chloride.....	.....	.....	0.07	0.16	.....
Calcium sulphide.....	} 3.00	} 0.50	0.89	0.63	.....
Magnesium sulphide.....			0.45	0.40	.....
Silica.....	.....	.....	.....	.....	.....
Total.....	149.10	132.70	132.18	127.64	119.50
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Sulphureted hydrogen.....	20.50	3.30	10.50	6.00	.....
Carbonic acid.....	.....	.....	4.58	2.22	.....
Atmospheric air.....	.....	.....	4.00	3.00	.....

Constituents.	Sharon Springs.			
	Chalybeate Spring.	Gardner Magnesia Spring.	Red Sulphur Spring.	White Sulphur Spring.
<i>Solids.</i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>e</sup></i>	<i>Grains per gallon.<sup>e</sup></i>	<i>Grains per gallon.<sup>f</sup></i>
Sodium carbonate.....	.....	0.34	0.34	.....
Calcium carbonate.....	.....	6.73	8.97	.....
Magnesium carbonate.....	8.96	0.80	0.41	.....
Sodium sulphate.....	3.74	.....	.....	.....
Calcium sulphate.....	63.80	93.50	96.64	55.84
Potassium sulphate.....	Trace	.....	.....	.....
Magnesium sulphate.....	8.15	19.68	18.96	21.20
Iron protosulphate.....	1.40	.....	.....	.....
Sodium chloride.....	.....	1.23	0.33	1.12
Calcium chloride.....	.....	0.16	0.06	.....
Magnesium chloride.....	.....	0.43	0.73	1.20
Sodium sulphide.....	.....	.....	.....	} \$1.12
Calcium sulphide.....	.....	} 6.25	0.89	
Magnesium sulphide.....	.....			.....
Silica.....	.....	0.40	0.45	.....
Organic matter.....	28.48	.....	.....	.....
Total .....	114.53	129.52	127.78	80.48
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Sulphureted hydrogen.....	.....	6.00	10.48	8.00
Carbonic acid.....	.....	2.21	4.56	.....
Atmospheric air.....	.....	3.00	4.00	.....
Total .....	.....	11.21	19.04	8.00

<sup>a</sup> Lawrence Reid, analyst (1845).<sup>b</sup> J. G. Pohle, analyst.<sup>c</sup> J. G. Pohle, analyst (1865).<sup>d</sup> Maische, analyst (1861).<sup>e</sup> Lawrence Reid, analyst.<sup>f</sup> J. R. Chilton, analyst.<sup>g</sup> With extractive matter.

## Analyses of mineral springs in New York—Continued.

Constituents.	Oak Orchard Acid Springs.					
	Spring No. 1.		Spring No. 2.	Oak Orchard Acid Water.		
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Parts in 1,000.<sup>e</sup></i>	<i>Parts in 1,000.<sup>f</sup></i>
Sodium sulphate.....	6.34	.....	.....	3.16	0.12	0.09
Calcium sulphate.....	74.89	39.60	12.41	13.72	1.11	1.12
Potassium sulphate.....	5.52	.....	.....	2.48	0.11	0.08
Aluminium sulphate.....	21.69	9.68	.....	6.41	0.37	0.32
Magnesium sulphate.....	35.60	8.28	4.98	8.49	0.46	0.53
Iron sulphate.....	.....	.....	39.23	.....	0.43	0.42
Iron protosulphate.....	28.62	14.32	.....	32.22	.....	.....
Sodium chloride.....	2.44	.....	.....	1.43	.....	0.04
Silica.....	4.59	1.04	1.84	3.33	0.06	0.07
Chlorine.....	.....	.....	.....	.....	Trace	.....
Organic matter.....	.....	3.28	10.88	6.65	Trace	.....
Sulphuric acid.....	134.73	82.96	129.06	133.31	2.01	2.01
Total.....	314.42	159.16	198.40	211.20	4.67	4.68

Constituents.	Massena or St. Regis Springs.	Messena Sulphur Springs.	Richfield Springs.				
			Name of spring unknown.	Sulphur Spring.	White Sulphur Spring.	Iron Spring.	Magnesia Spring.
<i>Solids.</i>	<i>Grains per gall.<sup>g</sup></i>	<i>Grains per gall.<sup>h</sup></i>	<i>Grains per gall.<sup>i</sup></i>	<i>Grains per gall.<sup>j</sup></i>	<i>Grains per gall.<sup>k</sup></i>	<i>Grains per gall.<sup>l</sup></i>	<i>Grains per gall.<sup>i</sup></i>
Calcium carbonate.....	.....	14.80	6.96	.....	.....	.....	.....
Calcium bicarbonate.....	4.85	.....	.....	24.47	.....	11.71	16.11
Magnesium carbonate.....	.....	.....	11.84	.....	.....	.....	.....
Magnesium bicarbonate.....	.....	.....	.....	6.01	31.74	12.52	3.97
Iron bicarbonate.....	0.49	.....	.....	0.24	Trace	4.92	0.13
Sodium hyposulphate.....	4.21	.....	.....	.....	.....	.....	.....
Sodium sulphate.....	0.50	.....	.....	22.29	.....	0.30	12.79
Sodium hydrosulphate.....	.....	.....	.....	.....	0.38	.....	.....
Calcium sulphate.....	60.03	68.40	20.00	67.39	112.34	5.00	38.63
Potassium sulphate.....	.....	.....	.....	.....	1.67	.....	.....
Strontium sulphate.....	.....	.....	.....	.....	0.01	.....	.....
Magnesium sulphate.....	.....	10.88	30.00	32.82	5.15	.....	18.81
Barium sulphate.....	.....	.....	.....	.....	Trace	.....	.....
Sodium phosphate.....	1.32	.....	.....	.....	.....	.....	.....
Calcium phosphate.....	.....	.....	.....	.....	Trace	.....	.....
Sodium chloride.....	76.79	.....	11.49	21.73	0.52	0.43	10.20
Calcium chloride.....	.....	10.64	.....	.....	.....	.....	.....
Potassium chloride.....	0.51	.....	.....	8.23	.....	.....	4.51
Magnesium chloride.....	29.93	.....	.....	.....	.....	.....	.....
Lithium chloride.....	.....	.....	.....	.....	0.02	.....	.....
Magnesium bromide.....	0.67	.....	.....	.....	.....	.....	.....
Sodium sulphide.....	1.40	.....	.....	.....	1.72	.....	.....
Sodium and calcium sulphides.....	.....	.....	.....	6.22	.....	.....	0.06
Calcium sulphide.....	.....	.....	.....	.....	0.09	.....	.....
Calcium and magnesium sulphides.....	.....	.....	2.00	.....	.....	.....	.....
Alumina.....	.....	.....	.....	0.10	Trace	.....	.....
Silica.....	.....	.....	.....	1.35	0.64	0.81	1.17
Organic matter.....	11.18	.....	153.50	.....	.....	.....	.....
Total.....	191.88	104.72	225.79	190.85	154.28	35.69	106.38
<i>Gases.</i>							
Sulphureted hydrogen.....	<i>Cub. in.</i> 5.307	<i>Cub. in.</i> .....	<i>Cub. in.</i> 24.24	<i>Cub. in.</i> 3.6288	<i>Cub. in.</i> 14.206	<i>Cub. in.</i> 15.9236	<i>Cub. in.</i> 0.3160
Carbonic acid.....	.....	.....	.....	2.9412	.....	.....	2.2032

<sup>a</sup> Silliman & Norton, analysts.<sup>b</sup> J. R. Chilton, analyst.<sup>c</sup> E. Emmons, analyst.<sup>d</sup> Porter, analyst.<sup>e</sup> H. Erni, analyst (1850).<sup>f</sup> W. J. Craw, analyst (1850).<sup>g</sup> Ford F. Mayer, analyst.<sup>h</sup> L. C. Beck, analyst.<sup>i</sup> Lawrence Reid, analyst.<sup>j</sup> Theo. Deecke, analyst.<sup>k</sup> C. F. Chandler, analyst.<sup>l</sup> With magnesium chloride.<sup>m</sup> With silicate of soda.<sup>n</sup> Undetermined matter.

*Analyses of mineral springs in New York — Continued.*

Constituents.	Saratoga Springs.				
	Champion Spouting Spring.	Columbian Springs.	Crystal Springs.	Congress Spring.	
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>e</sup></i>
Sodium carbonate .....	17.62	15.40	10.06	8.98	16.00
Sodium bicarbonate .....	227.07	68.00	101.88	98.10	144.00
Calcium carbonate .....	193.91	46.71	75.16	95.79	32.00
Calcium bicarbonate .....	0.08		Trace		
Magnesium bicarbonate .....	6.25		4.33		
Strontium bicarbonate .....		5.58		5.07	
Lithium bicarbonate .....					
Iron carbonate .....	0.65		2.04		
Iron bicarbonate .....	2.08		0.73		
Barium bicarbonate .....	0.25		2.16		
Potassium sulphate .....	0.01		Trace		
Sodium phosphate .....	Trace		Trace		
Sodium biphosphate .....	702.24	267.00	328.47	385.00	434.40
Sodium chloride .....	40.45		8.33		
Potassium chloride .....		Trace		Trace	
Potassium bromide .....	3.58		0.41		
Sodium bromide .....	Trace		Trace		
Calcium fluoride .....	0.23	2.56	0.06	3.50	
Sodium iodide .....	0.46		0.31		
Alumina .....	0.70	2.05	3.21	1.50	Trace
Silica .....	Trace		Trace		
Organic matter .....					
Total .....	1,195.58	407.30	537.15	597.94	626.40
<i>Gases.</i>					
Atmospheric air .....		4.50		7.00	
Azote .....					7.20
Carbonic acid .....	465.46	272.06	317.45	311.00	312.80

Constituents.	Saratoga Springs.				
	Congress Spring.			Empire Spring.	
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>g</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>
Sodium carbonate .....		0.56	7.20		
Sodium bicarbonate .....	10.77			9.02	30.85
Calcium carbonate .....		116.00	86.14		
Calcium bicarbonate .....	143.40	56.80	78.62	109.66	141.82
Magnesium carbonate .....				42.96	41.98
Magnesium bicarbonate .....	121.76			Trace	
Strontium bicarbonate .....	Trace			2.08	
Lithium bicarbonate .....	4.76				
Iron carbonate .....			0.84		
Iron bicarbonate .....	0.34			0.79	Trace
Barium bicarbonate .....	0.93			0.07	
Sodium sulphate .....			0.65		
Potassium sulphate .....	0.89			2.77	
Sodium phosphate .....	0.02			0.02	
Sodium biphosphate .....	Trace			Trace	
Sodium chloride .....	400.44	385.44	363.83	506.63	269.70
Potassium chloride .....	8.05			4.29	
Potassium bromide .....		Trace	15.92		
Sodium bromide .....	8.56			0.27	
Calcium fluoride .....	Trace			Trace	
Sodium iodide .....	0.14	4.02		Trace	12.00
Iron oxide .....		0.64			
Alumina .....	Trace		0.32	0.42	
Silica .....	0.84		0.47	1.46	
Organic matter .....				Trace	
Total .....	700.90	563.46	543.99	680.44	496.35
<i>Gases.</i>					
Atmospheric air .....			5.41		
Carbonic acid .....	392.30		284.65	344.67	

<sup>a</sup> C. F. Chandler, analyst (1871).<sup>b</sup> John H. Steele, analyst (prior to 1838).<sup>c</sup> C. F. Chandler, analyst.<sup>d</sup> John H. Steele, analyst.<sup>e</sup> J. D. Dana, analyst.<sup>f</sup> With iron.<sup>g</sup> Davy and Faraday, analysts, London.<sup>h</sup> J. R. Chilton, analyst (1843).<sup>i</sup> E. Emmons, analyst.<sup>j</sup> With sodium iodide.<sup>k</sup> Or iodine.

Analyses of mineral springs in New York—Continued.

Saratoga Springs.

Constituents.	Eureka Spring.	Excelsior Spring.	Flat Rock Spring.		Geyser Spout-ing Spring.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>e</sup></i>
Sodium bicarbonate .....	8.75	15.00	20.79	9.10	71.23
Calcium carbonate .....	.....	.....	60.57	.....	.....
Calcium bicarbonate .....	41.32	77.00	.....	98.63	168.39
Magnesium bicarbonate .....	29.34	32.33	42.70	29.47	149.34
Strontium bicarbonate .....	.....	.....	.....	0.01	0.43
Lithium bicarbonate .....	.....	.....	.....	3.23	9.00
Iron carbonate .....	.....	.....	5.39	.....	.....
Iron bicarbonate .....	3.00	3.22	.....	0.09	0.98
Barium bicarbonate .....	.....	.....	.....	0.10	2.01
Sodium sulphate .....	.....	1.32	.....	.....	.....
Potassium sulphate .....	.....	.....	.....	0.48	0.32
Strontium sulphate .....	.....	Trace	.....	.....	.....
Magnesium sulphate .....	2.15	.....	.....	.....	.....
Sodium phosphate .....	.....	.....	.....	0.04	Trace
Sodium baborate .....	.....	.....	.....	Trace	Trace
Sodium chloride .....	166.81	370.64	148.87	108.85	562.08
Potassium chloride .....	.....	.....	.....	7.99	24.64
Magnesium chloride .....	.....	.....	.....	10.83	.....
Potassium bromide .....	1.57	Trace	Trace	.....	.....
Sodium bromide .....	.....	.....	.....	0.32	2.21
Calcium fluoride .....	.....	.....	.....	.....	Trace
Sodium iodide .....	4.67	4.24	1.33	0.01	0.25
Alumina .....	0.23	.....	Trace	0.04	Trace
Silica .....	0.53	.....	Trace	1.34	0.66
Organic matter .....	.....	.....	.....	Trace	Trace
Sodium silicate .....	.....	4.00	.....	.....	.....
Potassium silicate .....	.....	7.00	.....	.....	.....
Total .....	258.37	514.75	279.65	270.53	991.54
<i>Gases.</i>	.....	.....	.....	.....	.....
Atmospheric air .....	.....	.....	6.50	.....	.....
Carbonic acid .....	239.00	250.00	287.50	.....	454.08

Saratoga Springs.

Constituents.	Hamilton Spring.		Hathorn Spring.	High Rock Springs.	
<i>Solids.</i>	<i>Grains per gallon.<sup>f</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>g</sup></i>	<i>Grains per gallon.<sup>h</sup></i>	<i>Grains per gallon.<sup>i</sup></i>
Sodium carbonate .....	.....	34.25	.....	.....	.....
Sodium bicarbonate .....	27.04	.....	4.29	34.89	17.54
Calcium carbonate .....	92.40	97.99	.....	.....	69.29
Calcium bicarbonate .....	.....	.....	170.65	131.74	.....
Magnesium carbonate .....	.....	39.06	.....	.....	.....
Magnesium bicarbonate .....	35.20	.....	176.46	54.92	61.59
Strontium bicarbonate .....	.....	.....	Trace	Trace	.....
Lithium bicarbonate .....	.....	.....	11.45	.....	.....
Iron carbonate .....	.....	4.62	.....	.....	5.58
Iron bicarbonate .....	5.39	.....	1.13	1.48	.....
Barium bicarbonate .....	.....	.....	1.74	Trace	.....
Potassium sulphate .....	.....	.....	.....	1.61	.....
Sodium phosphate .....	.....	.....	Trace	.....	.....
Calcium phosphate .....	.....	.....	.....	Trace	.....
Sodium baborate .....	.....	.....	Trace	.....	.....
Sodium chloride .....	297.30	298.66	509.97	390.13	189.10
Potassium chloride .....	.....	.....	9.60	8.50	.....
Potassium bromide .....	Trace	.....	.....	.....	Trace
Sodium bromide .....	.....	.....	1.53	0.73	.....
Calcium fluoride .....	.....	.....	Trace	Trace	.....
Sodium iodide .....	3.00	3.59	0.19	0.08	2.50
Alumina .....	.....	.....	0.13	1.22	Trace
Silica .....	.....	1.00	1.26	2.26	Trace
Organic matter .....	.....	.....	Trace	Trace	.....
Total .....	460.33	479.17	888.40	627.56	345.60
<i>Gases.</i>	.....	.....	.....	.....	.....
Atmospheric air .....	4.00	.....	.....	.....	5.00
Carbonic acid .....	316.00	320.00	375.75	409.46	304.00

<sup>a</sup> Allen, analyst.

<sup>b</sup> Allen, analyst (1879).

<sup>c</sup> John H. Steele, analyst.

<sup>d</sup> C. F. Chandler, analyst (1885).

<sup>e</sup> C. F. Chandler, analyst (1870).

<sup>f</sup> John H. Steele, analyst (prior to 1838).

<sup>g</sup> C. F. Chandler, analyst.

## Analyses of mineral springs in New York—Continued.

Constituents.	Saratoga Springs.			
	Kissingen or Triton Spring	Pavilion Spring.		Putnam Spring.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Sodium carbonate.....	67.62	3.76	4.92	14.32
Sodium bicarbonate.....	140.26	120.17	52.84	68.80
Calcium carbonate.....	70.47	76.27	56.92	51.60
Calcium bicarbonate.....	Trace	Trace	.....	.....
Magnesium carbonate.....	5.13	9.49	.....	.....
Magnesium bicarbonate.....	.....	.....	3.51	.....
Strontium bicarbonate.....	1.56	2.57	.....	7.00
Lithium bicarbonate.....	0.99	0.88	.....	.....
Iron carbonate.....	.....	.....	1.48	1.68
Iron bicarbonate.....	Trace	2.03	.....	.....
Barium bicarbonate.....	.....	Trace	.....	0.21
Sodium sulphate.....	.....	.....	0.19	.....
Potassium sulphate.....	.....	Trace	.....	.....
Sodium phosphate.....	.....	.....	.....	.....
Calcium phosphate.....	.....	Trace	.....	.....
Sodium biphosphate.....	338.50	459.90	187.68	214.00
Sodium chloride.....	16.98	7.66	.....	.....
Potassium chloride.....	.....	.....	2.59	Trace
Potassium bromide.....	1.80	0.99	.....	.....
Sodium bromide.....	Trace	Trace	.....	.....
Calcium fluoride.....	0.04	0.07	.....	2.00
Sodium iodide.....	Trace	0.33	0.42	0.56
Alumina.....	1.28	3.16	1.16	0.84
Silica.....	.....	Trace	.....	.....
Organic matter.....	.....	.....	.....	.....
Total.....	644.63	687.28	311.71	361.01
<i>Gases.</i>	.....	.....	.....	.....
Carbonic acid.....	361.50	332.46	359.50	326.40
Atmospheric air.....	.....	.....	5.30	6.40

Constituents.	Saratoga Springs.			
	New Putnam Spring.	Red Spring.	Saratoga A or Alum Spring.	Seltzer Spring.
<i>Solids.</i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>e</sup></i>
Sodium bicarbonate.....	8.08	15.33	6.75	29.43
Calcium bicarbonate.....	157.56	101.26	56.85	89.87
Magnesium bicarbonate.....	173.61	42.41	20.48	40.34
Strontium bicarbonate.....	0.11	Trace	.....	Trace
Lithium bicarbonate.....	9.83	0.94	1.72	0.90
Iron bicarbonate.....	0.45	.....	1.72	1.70
Barium bicarbonate.....	0.38	.....	.....	Trace
Sodium sulphate.....	.....	.....	2.50	.....
Calcium sulphate.....	.....	.....	0.45	.....
Potassium sulphate.....	2.26	.....	0.37	0.56
Magnesium sulphate.....	.....	.....	0.29	.....
Sodium phosphate.....	Trace	.....	.....	Trace
Calcium phosphate.....	.....	.....	.....	Trace
Sodium biphosphate.....	Trace	.....	.....	Trace
Sodium chloride.....	268.04	83.53	565.30	134.29
Calcium chloride.....	.....	.....	Trace	.....
Potassium chloride.....	14.87	6.86	0.36	1.34
Magnesium chloride.....	.....	.....	Trace	.....
Sodium bromide.....	1.62	.....	.....	0.63
Calcium fluoride.....	Trace	.....	.....	Trace
Sodium iodide.....	Trace	.....	.....	0.03
Boracic acid.....	.....	.....	.....	Trace
Iron oxide.....	.....	.....	.....	.....
Alumina.....	0.22	} <sup>b</sup> 2.10 }	0.38	0.37
Silica.....	3.00	3.25	1.46	2.56
Organic matter.....	Trace	.....	Trace	Trace
Total.....	640.03	255.68	658.63	302.02
<i>Gases.</i>	.....	.....	.....	.....
Carbonic acid.....	.....	.....	212.00	324.08

<sup>a</sup> Sharples, analyst (1872).<sup>b</sup> C. F. Chandler, analyst (1882).<sup>c</sup> J. R. Chilton, analyst (1840).<sup>d</sup> With sodium iodide.<sup>e</sup> Appleton, analyst.<sup>f</sup> J. G. Pohle, analyst.<sup>g</sup> C. F. Chandler, analyst (1869).<sup>h</sup> With traces of phosphates.

*Analyses of mineral springs in New York—Continued.*

Constituents.	Saratoga Springs.			
	Star Spring.	Union Spring.		United States Spring.
<i>Solids.</i>	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. per gall.<sup>b</sup></i>	<i>Grs. per gall.<sup>c</sup></i>	<i>Grs. per gall.<sup>a</sup></i>
Sodium carbonate.....	12.66	12.80	17.01	4.67
Sodium bicarbonate.....	124.46	41.60	96.70	93.12
Calcium carbonate.....	61.91	84.27	109.69	72.88
Calcium bicarbonate.....	Trace		Trace	0.02
Magnesium carbonate.....	1.59		2.61	4.85
Magnesium bicarbonate.....		5.45		
Strontium bicarbonate.....	1.21		0.27	0.71
Lithium bicarbonate.....	0.10		1.70	0.91
Iron carbonate.....	5.40		1.82	
Iron bicarbonate.....	Trace		0.03	0.02
Barium bicarbonate.....	Trace		Trace	Trace
Potassium sulphate.....	398.36	243.62	453.30	141.87
Sodium phosphate.....	9.70		8.73	8.62
Sodium biphosphate.....		Trace		
Sodium borate.....	0.57		1.30	0.84
Sodium chloride.....	Trace		Trace	Trace
Potassium chloride.....	0.13	3.60	0.04	0.05
Potassium bromide.....	Trace		0.32	0.09
Sodium iodide.....	1.28	1.57	2.65	3.19
Alumina.....	Trace		Trace	Trace
Silica.....	Trace		Trace	Trace
Organic matter.....	Trace		Trace	Trace
<b>Total.....</b>	<b>617.37</b>	<b>392.91</b>	<b>696.17</b>	<b>331.84</b>
<i>Gases.</i>				
Carbonic acid.....	407.65	344.16	384.97	245.73
Atmospheric air.....		4.62		

Constituents.	Saratoga Springs.			
	Vichy Spring.	Walton or Iodine Spring (Star Spring).	Washington Spring.	
<i>Solids.</i>	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. per gall.<sup>d</sup></i>	<i>Grs. per gall.<sup>e</sup></i>	<i>Grs. per gall.<sup>f</sup></i>
Sodium carbonate.....	82.87	2.00	8.48	16.50
Sodium bicarbonate.....	95.52	26.00	84.10	92.60
Calcium carbonate.....	41.50	75.00	65.97	40.92
Calcium bicarbonate.....	Trace			
Magnesium carbonate.....	1.76			
Strontium bicarbonate.....		1.00		3.25
Lithium bicarbonate.....	0.05		3.80	
Iron carbonate.....	0.59			
Iron bicarbonate.....	Trace		0.05	
Barium bicarbonate.....	Trace			
Potassium sulphate.....	Trace			
Magnesium sulphate.....	Trace			
Sodium phosphate.....	Trace			
Sodium biphosphate.....	128.69	187.00	182.73	281.50
Sodium chloride.....			0.20	
Calcium chloride.....	14.11		0.68	
Potassium chloride.....			0.47	
Potassium bromide.....	0.99			
Sodium bromide.....	Trace			
Calcium fluoride.....	Trace			
Sodium iodide.....	Trace	3.50	2.24	2.75
Alumina.....	0.48		Trace	
Silica.....	0.76		1.50	1.50
Organic matter.....	Trace			
<b>Total.....</b>	<b>367.32</b>	<b>294.50</b>	<b>350.22</b>	<b>439.02</b>
<i>Gases.</i>				
Carbonic acid.....	383.07	326.00	363.77	262.50
Atmospheric air.....		4.00		6.80

<sup>a</sup> C. F. Chandler, analyst.<sup>b</sup> J. R. Chilton, analyst (1841).<sup>c</sup> C. F. Chandler, analyst (1873).<sup>d</sup> E. Emmons, analyst (1839).<sup>e</sup> J. R. Chilton, analyst.<sup>f</sup> John H. Steele, analyst (prior to 1838).

## NEW JERSEY.

This State is not conspicuous for the number of her mineral springs. Schooley's Mountain Spring is the only well-known resort.

The water of a spring at Woodbridge, in Middlesex County, was at one time bottled for sale, but so far as reported none of the waters of the State is on sale at present. Unimproved weak chalybeate springs doubtless exist in many portions of the State, but they are at present of comparatively little importance.

A number of artesian wells have been sunk at Newark, Paterson, Jersey City, and in other parts of the State, and the water in many of them is quite highly mineralized. Several of the analyses are included in the table. So far as known, they are not utilized medicinally.

*Mineral springs of New Jersey.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Artesian wells:*</i>			o		
At Passaic Rolling Mill, Paterson, Passaic County.	.....	.....	.....	.....	Saline.
At Celluloid Works, Newark, Essex County.	.....	.....	.....	.....	Calcic, saline.
On Passaic River (Lister Brothers), Newark, Essex County.	.....	.....	55½	.....	Do.
At Limbeck & Betz's, Ninth street, Jersey City, Hudson County.	.....	.....	52½	.....	Saline.
At Winslow, Camden County.	.....	.....	.....	.....	Alkaline.
Bishop's Well (45 feet), New Brunswick, Middlesex County.	.....	.....	.....	Calcic	.....
Manasquan Spring, Point Pleasant, Ocean County.	.....	.....	.....	.....	.....
<i>Mineral springs:</i>					
At Oceanville, (?) Monmouth Co...	.....	.....	.....	.....	.....
On Pohateong Mountain, near Broadway, Warren County.	.....	.....	.....	.....	.....
Paint Spring, Kittatinny Mountain, Warren County, near Delaware Gap Water.	.....	.....	.....	.....	.....
Schooley's Mountain Spring, Schooley's Mountain, Morris County.	1	20	58	Chalybeate ...	Resort.
Spa Spring, Woodbridge, Middlesex County.	1	.....	Cold	Chalybeate ...	Unimproved, but was once bottled and sold.
Warwick Spring, Newark, Essex Co...	.....	.....	.....	Saline.....	.....

\* Only those of which analyses are given in the table are included here.

*Analyses of mineral springs in New Jersey.*

Constituents.	Schooley's Mountain Spring.	Warwick Spring.	Artesian Wells.	
			Passaic Roll- ing Mill.	Lister Bros., Newark.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>
Sodium carbonate .....	0.58	11.27		
Sodium bicarbonate .....				1.55
Magnesium carbonate .....	1.60	18.09		
Magnesium bicarbonate .....				
Iron carbonate .....	0.58	2.72		
Iron bicarbonate .....	Trace			
Manganese carbonate .....	1.42	41.82		
Calcium carbonate .....		18.43		
Calcium bicarbonate .....			120.70	106.98
Ammonium bicarbonate .....	1.68			15.94
Calcium sulphate .....				25.87
Sodium sulphate .....				
Magnesium sulphate .....	0.14	0.70		
Alumina .....	Trace			
Ammonia .....	0.74	0.82		
Silicic acid .....	0.43	13.41	408.46	2.47
Sodium chloride .....		5.40	5.54	
Potassium chloride .....			278.32	
Calcium chloride .....			109.44	
Magnesium chloride .....			7.00	
Iron and aluminium chlorides .....		Trace		
Sodium bromide .....		0.09		
Sodium phosphate .....		Trace		
Potassium nitrate .....		Trace		
Organic matter .....		Trace		
Bromide .....			Trace	
Iodine .....			Trace	
Total .....	7.17	112.75	929.46	152.81
<i>Gas.</i>				
Carbonic acid .....	<i>Cubic inches. Undetermined</i>	<i>Cubic inches. 101.03</i>	<i>Cubic inches. Undetermined</i>	<i>Cubic inches. Undetermined</i>

Constituents.	Artesian Wells.			Bishop's Well, New Bruns- wick.
	Celluloid Works, New- ark.	Limbeck & Betz's, Jersey City.	Winslow.	
<i>Solids.</i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Parts in 1,000.<sup>d</sup></i>	<i>Grains per gallon.</i>
Magnesium carbonate .....	6.10			30.88
Magnesium sulphate .....				148.62
Calcium sulphate .....				
Sodium sulphate .....	11.70			
Magnesium sulphate .....	18.70			
Calcium sulphate .....	85.10			
Silicic acid .....	2.00		.0140	
Potash .....			.0100	
Sodium chloride .....	0.60			10.00
Soda .....		39.50	.0554	
Lime .....		6.95	.0202	
Magnesia .....		9.36	.0079	
Sulphuric acid .....		4.11	.0027	
Chlorine .....		65.50	.0002	
Carbonic acid .....			.0520	
Iron peroxide .....			.0030	
Total .....	124.20	125.42	.1654	189.50

<sup>a</sup> C. McIntyre, jr., analyst (1870).

<sup>b</sup> C. F. Chandler, analyst (1870).

<sup>c</sup> New Jersey State Geologist's Report, 1880.

<sup>d</sup> New Jersey State Geologist's Report, 1879.

## PENNSYLVANIA.

Very little has ever been published with especial reference to Pennsylvania mineral waters. Walton's Mineral Springs of the United States and Canada (edition of 1883) credits the State with eight locations. In Moorman's book of 1873 thirteen are mentioned, while Pepper's list of 1880 contains thirty-two. In the present list forty-four are included, of which sixteen are places of resort and five are used commercially. Several of the springs have been popular resorts for years. Bedford Springs has been so utilized since 1804. Next to these the Gettysburg Springs are probably as well known as any other in the State. Cresson, Minnequa, and Blossburg Springs are also among the most important. The Bath Spring at Bristol, which was a place of considerable resort in Revolutionary times, has so declined in importance that few are aware even of its existence. Some of the springs, like those at Ephrata, Yellow Springs, and Caledonia Springs, are summer resorts, but the waters can scarcely be called mineral waters, as they are merely notable for their purity and the desirability of their situation.

The Reports of the Second Geological Survey present much information in relation to the mineral springs of Pennsylvania, and contain many analyses, made mostly by Dr. Genth. These have been drawn upon and form the majority of the analyses given in the table following the list of springs.

The chalybeate springs, as in most of the neighboring States, outnumber the others. There are a large number of sulphureted waters and one spring (Blossburg) is known to contain free sulphuric acid. The Perry County Spring is the only warm spring. In most of the books the temperature of this spring is given as from 70° to 72° Fahr., but information derived directly from the spring owner gives it as 66° Fahr.

*Mineral springs of Pennsylvania.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Adams White Sulphur Springs, 1 mile north of Chaneyville, Bedford Co.	.....	.....	.....	Sulphureted .....	Once had considerable reputation as a resort.
Addison Ridge Chalybeate Springs, Monroe Township, Bedford County.	4	.....	.....	Chalybeate .....	
Alum Rock Spring, Alum Rock, Clarion County.	.....	.....	.....	do .....	
Bath Chalybeate Spring, Bristol, Bucks County.	1	.....	.....	do .....	Was once a resort.
Bedford Springs, Bedford, Bedford County.	7	2,400	{52.7 to 62.6}	Saline, sulphureted, and chalybeate.	Used commercially and as a resort.
Black Barren Spring, Pleasant Grove, Lancaster County.	1	60	52	.....	Do.
Blossburg Springs, Blossburg, Tioga County.	2+	.....	.....	Acid, chalybeate	Has considerable local reputation.
Caledonia or Sweeney's Springs, 15 miles from Chambersburg, Franklin Co.	.....	.....	.....	.....	Summer resort.
Carlisle White Sulphur Springs, near Carlisle, Cumberland County.	3	60	.....	Mild sulphurous	Resort to limited extent.

*Mineral springs of Pennsylvania—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Chalybeate springs:</i>			°		
Four miles from Pittsburgh, Allegheny County.					
Two miles north of Chambersburg, Franklin County.			53		
Cresson Springs, Cresson Cambria Co.	3			Chalybeate, &c.	Resort.
Doubling Gap White Sulphur Springs, Doubling Gap, near Newville, Cumberland County.	5			Sulphureted and chalybeate.	Do.
East Clarion Spring, Elk County				Saline	
Ephrata Spring, Ephrata, Lancaster Co.			57		Do.
Fayette Spring, Fayette Springs, Fayette County.	1		48	Chalybeate	Once a resort.
Frankfort Springs, Frankfort Springs, Beaver County.	9	200+	42-48	do	Resort.
Gettysburg Katalysine Spring, Gettysburg, Adams County.			57	Alkaline.	Used commercially.
Gettysburg Lithia Spring, Gettysburg, Adams County.				do	Do.
Guylick and Gaylord's Spring, Blossburg, Tioga County.	1	160		Acid chalybeate.	Do.
Haier's Chalybeate Spring, 1 mile northeast of Bedford, Bedford County.	1			Chalybeate	Resort.
Kane Geyser Well (2,000 feet), near Sargent, McKean County.				Saline	
Kane Sulphur Spring, 2½ miles northwest of Kane, McKean County.				Sulphureted	Unimproved.
Kittanning Mineral Spring, Kittanning, Armstrong County.				Calcic, chalybeate.	
Lovett Sulphur Springs, 1 mile from Loretto and near Wildwood Springs, Cambria County.				Sulphureted	Do.
May's Springs, Milligan's Cove, Harrison Township, Bedford County.	2+			Chalybeate	
McCarthy's or Saltillo Mineral Springs, near Saltillo, Huntingdon County.	2+	60	60	Calcic	Resort to limited extent.
McElroy's Spring, Westmoreland Co.				Chalybeate	Local resort.
McVitty's Spring, near Saltillo, Huntingdon County.	1	125	53	Calcic	Used slightly as a resort.
<i>Mineral springs:</i>					
Near Clarion, Clarion County				Chalybeate	Unimportant.
Rose Valley, near Reading, Berks Co.				do	
Hanover, York County.				do	
Minnequa Springs, near Minnequa, Bradford County.	3	600+	47	Chalybeate, sulphureted.	Resort and water sold to limited extent.
Perry County Warm Spring, Perry County, 14 miles from Harrisburg.	1	5,400	66	Alkaline, calcic.	Has been a resort; abandoned now.
Reed and Lyon White Sulphur Spring, Milligan's Cove, in Harrison Township, near Bedford Springs, Bedford County.	1			Sulpho-chalybeate.	Resort.
Saline Spring (Mr. Peterson's), near Tarentum, Allegheny County.					
<i>Salt springs:</i>					
Near Conemaugh, near Saltsburg, Indiana County.					
Near Alba, Bradford County.					
<i>Sulphur springs:</i>					
Near head of Mill Creek, in Mead Township, Crawford County.					
On Ander's Run, 2½ miles southwest of Ironton, Warren County.					
On Ben's Creek, Somerset County.					
In Toboyne Township, Perry Co.	2				
Three Springs, Three Springs, Huntingdon County.	3			Sulphureted, &c	Do.
Wildwood Springs, Loretto, Cambria, County.	3			Chalybeate, &c	Do.
Wolford's White Sulphur Springs, Wolford's Gap, Bedford County.					
Yellow Springs, Chester County					Do.
York Sulphur Springs, York Sulphur Springs, Adams County.	2				Do.

*Analyses of mineral springs in Pennsylvania.*

Constituents.	Bedford Springs.				
	Sweet Spring.	Magnesia Iron Spring.	Sulphur Spring.	Magnesia Spring.	Large Limestone Spring.
	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. per gall.<sup>a</sup></i>
Calcium carbonate .....	0.52	8.47	10.21	10.43	7.09
Magnesium carbonate.....	0.14	0.59	1.00	0.94	1.88
Manganese carbonate .....	.....	Trace	Trace	Trace	Trace
Iron carbonate.....	.....	0.05	0.08	0.04	0.04
Sodium sulphate .....	.....	0.61	0.51	0.33	.....
Calcium sulphate .....	.....	90.46	73.08	99.83	0.58
Potassium sulphate .....	.....	0.30	0.41	0.18	0.27
Strontium sulphate .....	.....	0.01	.....	0.13	0.03
Magnesium sulphate .....	.....	38.68	33.40	39.62	0.20
Barium sulphate .....	.....	.....	.....	Trace	.....
Calcium phosphate.....	.....	0.02	0.02	0.01	Trace
Sodium chloride.....	.....	0.53	0.37	0.46	0.23
Potassium chloride.....	.....	.....	.....	.....	Trace
Lithium chloride.....	.....	Trace	Trace	Trace	.....
Silica.....	0.65	0.17	0.54	0.77	0.47
Hydrosulphuric acid .....	.....	0.01	0.03	Trace	Trace
Carbonic acid .....	0.31	1.27	2.79	0.56	3.77
Total.....	1.62	141.17	122.49	153.30	14.70

  

Constituents.	Bedford Springs.		Hafer's Chalybeate Spring.	Black Barren Spring.	Fayette Spring.
	Chalybeate Spring.	Anderson Spring.			
	<i>Grs. per gall.<sup>b</sup></i>	<i>Grs. per gall.<sup>c</sup></i>	<i>Grs. per gall.<sup>b</sup></i>	<i>Grs. per gall.<sup>d</sup></i>	<i>Grs. per gall.<sup>c</sup></i>
Sodium carbonate .....	0.40	.....	0.75	.....	.....
Potassium carbonate .....	0.13	.....	0.25	.....	.....
Calcium carbonate .....	8.85	8.00	11.34	.....	.....
Calcium bicarbonate .....	.....	.....	.....	.....	9.33
Magnesium carbonate.....	1.20	.....	2.52	.....	.....
Magnesium bicarbonate.....	.....	.....	.....	.....	1.53
Manganese carbonate .....	Trace	.....	0.02	.....	.....
Manganese bicarbonate .....	.....	.....	.....	.....	0.05
Iron carbonate .....	0.44	5.00	0.36	.....	.....
Iron bicarbonate .....	.....	.....	.....	.....	1.07
Sodium sulphate .....	.....	.....	.....	1.21	0.20
Calcium sulphate .....	2.74	15.00	4.40	.....	0.06
Potassium sulphate .....	.....	.....	.....	.....	0.11
Magnesium sulphate .....	.....	80.00	.....	3.24	0.25
Calcium phosphate .....	0.03	.....	0.03	.....	0.05
Sodium chloride.....	0.12	10.00	0.18	.....	0.09
Calcium chloride.....	.....	3.00	.....	.....	.....
Lithium chloride.....	.....	.....	Trace	.....	.....
Alumina .....	.....	.....	.....	.....	Trace
Silica.....	0.79	.....	0.86	1.30	1.20
Hydrosulphuric acid .....	Trace	.....	.....	.....	.....
Carbonic acid (free) .....	5.60	.....	.....	.....	0.38
Nitrous acid .....	.....	.....	.....	.....	Trace
Loss .....	.....	3.00	.....	.....	.....
Total .....	20.30	124.00	20.71	5.75	14.32

  

	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
<i>Gas.</i>					
Carbonic acid .....	.....	74.00	.....	.....	.....

<sup>a</sup> F. A. Genth, analyst (1878).<sup>b</sup> F. A. Genth, analyst.<sup>c</sup> Dr. Church, analyst.<sup>d</sup> Rand & Cresson, analysts.<sup>e</sup> F. A. Genth, analyst (1875).

*Analyses of mineral springs in Pennsylvania—Continued.*

Constituents.	Cresson Springs.			Gettysburg Katalysine Spring.	
	Iron Spring.	Alum Spring.	Magnesia Spring.		
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grainss per imp. gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Sodium carbonate .....				46.05	
Sodium bicarbonate .....			1.43		0.70
Potassium bicarbonate .....			0.21	Trace	16.41
Calcium bicarbonate .....	3.53		0.02	81.00	16.41
Magnesium bicarbonate .....			0.41	76.05	0.54
Nickel bicarbonate .....					Trace
Manganese bicarbonate .....		Trace	Trace		0.01
Iron bicarbonate .....	5.04	3.75	0.02	Trace	0.04
Cobalt bicarbonate .....					Trace
Copper bicarbonate .....					Trace
Magnesium borate .....					0.03
Sodium sulphate .....	1.64	0.70			2.47
Calcium sulphate .....	48.92	40.20	0.11	53.20	0.83
Potassium sulphate .....	0.32	0.43			0.21
Strontium sulphate .....					Trace
Lithium sulphate .....	Trace	0.05			
Magnesium sulphate .....	22.58	27.70			0.78
Aluminium sulphate .....	1.60	21.20			
Barium sulphate .....					Trace
Iron sulphate .....	23.48	16.25			
Iron persulphate .....	Trace	33.39			
Calcium phosphate .....	0.03	Trace	Trace	Trace	0.01
Sodium chloride .....	0.04	0.02	1.23	Trace	0.66
Calcium chloride .....			1.30		
Magnesium chloride .....			0.56		
Lithium chloride .....				Trace	Trace
Magnesium bromide .....				Trace	
Calcium fluoride .....					0.01
Alumina .....			0.01		Trace
Silica .....	1.21	1.87	0.92		
Silicic oxide .....				10.00	2.03
Carbonic acid (free) .....			0.66		
Nitrous acid .....			Trace		
Organic matter .....					40.71
Impurities .....					1.10
Total .....	108.39	145.56	6.88	266.30	26.54

<sup>a</sup> F. A. Genth, analyst (1875).<sup>b</sup> A. M. Mayer, analyst.<sup>c</sup> F. A. Genth, analyst (1874).<sup>d</sup> With nitric acid.

*Analyses of mineral springs in Pennsylvania—Continued.*

Constituents.	Gettysburg Lithia Spring.			East Clarion Spring.	Kane Geyser Well.
	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. per gall.<sup>b</sup></i>	<i>Grs. per gall.<sup>c</sup></i>	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. per gall.<sup>d</sup></i>
Sodium bicarbonate.....	3.20	4.97	3.38		
Calcium carbonate.....					4.14
Calcium bicarbonate.....	10.71	8.00	9.96	9.80	
Magnesium carbonate.....					0.36
Magnesium bicarbonate.....	5.31	7.31	5.83	0.58	
Strontium bicarbonate.....				Trace	
Manganese carbonate.....			Trace		Trace
Iron carbonate.....					7.77
Iron bicarbonate.....	0.03	0.05	0.04	0.72	
Barium bicarbonate.....				0.13	
Ammonium nitrate.....				0.19	
Magnesium nitrate.....				0.14	
Sodium sulphate.....		0.20			
Calcium sulphate.....	0.48	0.25	0.43		35.40
Potassium sulphate.....	0.15		0.15		
Magnesium sulphate.....	3.30		3.30		
Calcium phosphate.....			0.01	Trace	0.07
Sodium chloride.....	0.28		0.32	336.80	6455.87
Calcium chloride.....				51.86	2871.32
Potassium chloride.....		0.11		0.90	2.63
Strontium chloride.....				0.06	
Magnesium chloride.....				15.34	555.95
Iron chloride.....					2.49
Lithium chloride.....			Trace	Trace	2.66
Barium chloride.....				1.72	
Magnesium bromide.....					78.94
Magnesium iodide.....					0.88
Lithia.....		Trace			
Alumina.....			0.02		
Silica.....			1.76	0.70	
Silicic oxide.....	1.78	0.17			0.47
Total.....	25.24	21.06	25.25	418.94	10016.94

  

Constituents.	Kittanning Mineral Spring.	May's Chalybeate Spring.	McCarthy's Springs.	McVitty's Spring.	Mineral Spring, Hanover.
	<i>Grs. per gall.<sup>e</sup></i>	<i>Grs. per gall.<sup>e</sup></i>	<i>Grs. per gall.<sup>e</sup></i>	<i>Grs. per gall.<sup>e</sup></i>	<i>Grs. per gall.<sup>f</sup></i>
Sodium carbonate.....					Trace
Calcium carbonate.....		6.67			029
Calcium bicarbonate.....	16.05		22.24	9.84	
Magnesium carbonate.....		1.13			
Magnesium bicarbonate.....			0.88	1.87	
Manganese bicarbonate.....	0.25				
Iron carbonate.....		0.06			
Iron bicarbonate.....			0.08	0.14	
Sodium sulphate.....	8.73	1.31	7.79	1.01	
Calcium sulphate.....	65.12	4.55	72.20		
Aluminium sulphate.....	1.53				
Potassium sulphate.....	0.91	0.44	0.22	0.16	
Magnesium sulphate.....	26.85	2.25	41.80	Trace	042
Iron sulphate.....	24.49				
Calcium phosphate.....	0.11	0.05	Trace	Trace	
Sodium chloride.....	0.65	0.46	0.21	0.06	
Lithium chloride.....		Trace			
Magnesium protoxide.....					021
Iron protoxide.....					184
Alumina.....					016
Silica.....	1.17	0.83	1.17	0.59	
Hydrosulphuric acid.....			0.02	0.02	
Carbonic acid.....		5.46			
Total.....	145.86	23.26	146.61	13.69	292

<sup>a</sup> F. A. Genth, analyst (1874).<sup>b</sup> O. Oldsburg, analyst.<sup>c</sup> F. A. Genth, analyst (1875).<sup>d</sup> F. A. Genth, analyst (1880).<sup>e</sup> F. A. Genth, analyst.<sup>f</sup> Prof. Hollenbush, analyst.

*Analyses of mineral springs in Pennsylvania—Continued.*

Constituents.	Kane Sulphur Spring.	Minnequa Springs.		Reed and Lyon White Sulphur Spring.
	Grains per gallon. <sup>a</sup>	Grains per gallon. <sup>b</sup>	Grains per gallon. <sup>c</sup>	Grains per gallon. <sup>a</sup>
Sodium carbonate	1.44	1.33	1.09	0.54
Sodium bicarbonate				
Potassium carbonate	0.46	0.14		
Potassium bicarbonate				
Calcium carbonate	4.78		0.73	5.58
Calcium bicarbonate		6.53		
Magnesium carbonate	0.85		1.27	1.29
Magnesium bicarbonate		1.59		
Nickel carbonate	Trace			
Manganese carbonate	0.02			
Manganese bicarbonate	Trace	0.06		
Zinc bicarbonate		0.01		
Iron carbonate	0.10	Trace		0.43
Iron bicarbonate		0.04		
Barium bicarbonate		0.01		
Magnesium borate		0.08		
Ammonium nitrate		Trace		
Ammonium nitrite				
Sodium sulphate				1.01
Calcium sulphate	0.07		0.49	0.36
Potassium sulphate				0.22
Magnesium sulphate				0.98
Barium sulphate		Trace		
Calcium phosphate	0.01	0.01		Trace
Sodium chloride	0.77	0.19	1.03	0.19
Potassium chloride			Trace	
Lithium chloride	Trace	Trace		Trace
Iron protoxide			3.70	
Alumina	0.03	Trace		
Silica	0.60	0.75		1.81
Sulphur			1.34	
Hydrosulphuric acid	Trace	0.01		0.06
Carbonic acid	3.19			1.29
Organic matter			0.74	
Total	12.32	10.75	10.39	13.76

Constituents.	Sulphur Spring, Ander's Run.	Blossburg Springs.	Perry County Warm Spring.	Guylyck and Gaylord's Spring.
	Grains per gallon. <sup>a</sup>	Grains per gallon. <sup>a</sup>	Grains per gallon. <sup>d</sup>	Grains per gallon. <sup>c</sup>
Sodium carbonate	7.49			
Potassium carbonate	0.51			
Calcium carbonate	4.75		2.67	
Magnesium carbonate	2.47		1.94	
Iron carbonate	0.18			
Sodium sulphate		0.27		0.25
Calcium sulphate	0.61	23.13		17.91
Aluminium sulphate		6.58		0.55
Potassium sulphate		0.24		
Lithium sulphate		0.12		
Magnesium sulphate		13.10		15.55
Manganese sulphate		1.83		
Nickel sulphate		0.36		
Cobalt sulphate		0.03		
Iron sulphate				73.06
Iron persulphate		31.32		
Iron phosphate		0.33		
Sodium chloride	0.98	0.10		
Alkaline salts (chiefly chlorides)			1.09	
Silica	0.61	2.15	0.60	0.56
Sulphuric acid		5.64		3.10
Carbonic acid	6.60			
Organic matter			2.90	
Total	24.20	85.20	9.20	110.98

<sup>a</sup> F. A. Genth, analyst.<sup>b</sup> F. A. Genth, analyst (1875).<sup>c</sup> Dr. Gregg, analyst.<sup>d</sup> James C. Booth, analyst (1850).<sup>e</sup> S. A. Lattimore, analyst (1885).

## SOUTHERN ATLANTIC STATES.

The general geologic features of the Southern Atlantic States are very much like those of the Northern Atlantic division and the mineral springs are also similar. Sulphureted waters and chalybeate springs are most prominent in both. There is, however, this difference: thermal springs, which are of infrequent occurrence in the northern section, are quite numerous in the southern. This is probably due to the fact that faulted strata are more prevalent in the Southern Appalachians than in the Northern, which recent observations by members of the United States Geological Survey (most of them still unpublished) seem to indicate is the case. The connection of many noted European springs with dislocated strata has long been known, and Prof. W. B. Rogers also called attention to the same state of things in Virginia, in his memoir *On the Connection of Thermal Springs in Virginia with Anticlinal Axes and Faults*, published (1840-1842) in the *Transactions of the Association of American Geologists and Naturalists*.

The Southern Atlantic States have more springs that are utilized for places of resort than has any other section, except the Southern Central States.

Virginia stands at the head of the section in this respect. Only one State (Tennessee) in any other section has more, and in the latter case probably more of the localities are used simply as local resorts.

A large number of the springs in this section are still unknown so far as a definite statement of their chemical constituents is concerned, but every year adds to the list of analyses.

*Summary for Southern Atlantic States.*

States.	Number of spring localities.	Number of individual springs.	Number of springs analyzed.	Number of spring localities utilized as resorts.	Number of springs used commercially.	Total number of analyses.
Delaware .....	5	5	0	0	0	0
Maryland .....	29	101	4	5	1	4
District of Columbia .....	2	4	0	0	0	0
Virginia .....	97	307	75	54	21	87
West Virginia .....	38	69	20	15	6	22
North Carolina .....	77	175	19	33	8	20
South Carolina .....	31	39	6	8	3	6
Georgia .....	55	290	20	26	3	21
Florida .....	37	58	4	11	0	4
Total .....	371	1,048	148	152	42	164

## DELAWARE.

From the few reports of geological surveys of Delaware we learn that chalybeate springs are numerous, as would naturally be expected from its geological structure.

They are, however, of comparatively little importance, only one, so far as learned, having ever been utilized as a place of resort, viz, the Brandywine Chalybeate Spring, which has long been abandoned.

The table includes all the springs of which mention could be obtained by correspondence.

*Mineral springs of Delaware.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Brandywine Chalybeate Spring, Faulkland, west of Wilmington, New Castle County.	1	.....	°	Chalybeate .....	Once improved and used as a resort.
<i>Mineral springs:</i> Near Dagsborough, Sussex County.	.....	.....	.....	.....	Unimproved and unimportant.
Two miles from Dover, Kent Co.	.....	.....	.....	Chalybeate .....	Unimproved.
Ten miles from Dover, Kent Co.	.....	.....	.....	Sulphureted .....	Do.
At Smyrna, Kent County.	.....	.....	.....	.....	Unimproved and filled up.

## MARYLAND.

The general works on mineral springs give no space to Maryland and Dr. Pepper's list includes but one locality, viz, the Carroll White Sulphur Springs of Alleghany County, which at present, so far as we can learn, is not resorted to.

There are several localities that were once used extensively, but have fallen into disuse.

The proximity of many of the springs to those of Virginia has probably caused them to be neglected. Still there are several places of resort, and the water of one—the Strontia Well of Brooklandville—is used commercially. In the eastern part of the State the springs are mainly chalybeate, the majority of them unimproved and unimportant.

*Mineral springs of Maryland.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Barren Creek Springs, Barren Creek Springs, Wicomico County.	.....	.....	o	Chalybeate	Once used extensively.
Belinda Spring, 14 miles from Sharpsburg, Washington County.	1	.....	.....	.....	Once a resort but now unimproved.
Bentley's Springs, Bentley's Springs, Baltimore County.	50	.....	.....	Alkaline, chalybeate, &c.	Resort.
Bevy Springs, old Carroll estate, Takoma Park, Montgomery County.	7	.....	.....	Chalybeate, &c.	.....
Bingham Spring, $\frac{3}{4}$ miles northeast of Wittman, Talbot County.	.....	.....	.....	.....	Unimproved.
Blue Sulphur Springs, Piney Grove, Allegheny County.	5	.....	.....	.....	Do.
<i>Calcic springs:</i> Near Hagerstown, Washington Co.	.....	.....	.....	.....	Limestone springs are common.
Carroll White Sulphur Springs, between Green Ridge and Polish Mountain, Allegheny County.	4	.....	48	Sulphureted	.....
<i>Chalybeate springs:</i> Six miles from Easton, Talbot Co.	.....	.....	.....	.....	.....
Near Hancock, Washington Co.	2	.....	.....	.....	Unimproved.
Near New Windsor, Carroll Co.	.....	.....	.....	.....	.....
In Queen Anne's County	.....	.....	.....	.....	Do.
Ennall's Spring, south of Trappe, Talbot County.	.....	.....	.....	.....	.....
Flint Stone Mineral Springs, Flint Stone, Allegheny County.	.....	100	Cold	Saline	Used locally.
Goldsborough Springs, 2 miles southeast of Dundee, Talbot County.	.....	.....	.....	.....	Unimproved.
Lloyd's Spring, Near Lloyd's Landing, Talbot County.	.....	.....	.....	.....	Do.
<i>Mineral springs:</i> Near Clear Spring, Washington Co.	.....	.....	.....	.....	.....
At Mineral Spring, Garrett County.	1	.....	.....	Sulpho-chalybeate.	Do.
At Green Spring Furnace, Washington County.	2	.....	.....	Saline, chalybeate, and lithia.	.....
Outram Springs, south of Easton, Talbot County.	.....	.....	.....	.....	Do.
Ridgeway's Springs, west of Easton, Talbot County.	.....	.....	.....	.....	Do.
River Springs, River Springs, Saint Mary's County.	9	100	.....	Chalybeate, &c.	Resort.
Spa Spring, Bladensburg, Prince George's County.	1	180	56	Saline, chalybeate.	Do.
Strontia Mineral Spring, Brooklandville, Baltimore County.	1	350	50	do	Used commercially.
<i>Sulphur springs:</i> At Sulphur Springs Station, B. & P. R. R., Baltimore County.	.....	.....	.....	.....	Unimportant and unimproved.
Near Williamsport, Washington County.	.....	.....	.....	.....	Unimproved.
Near Indian Springs, Washington County.	.....	.....	.....	.....	Unimproved and unimportant.
Warm Springs, 1 mile from Flint Stone, Allegheny County.	.....	.....	64	.....	.....
Windsor Sulphur Springs, near Windsor, Carroll County.	.....	.....	.....	Sulphureted, &c.	Resort.

*Analyses of mineral springs in Maryland.*

Constituents.	Strontia Mineral Spring.	Bentley's Springs.		Flint Stone Mineral Springs.
		Chalybeate Spring.	Station Spring.	
	<i>Parts in 100,000.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Sodium carbonate .....		0.46	0.37	
Magnesium carbonate .....		0.68	0.26	
Calcium carbonate .....		0.64	0.34	
Calcium bicarbonate .....	6.75			
Strontium bicarbonate .....	1.86			
Iron carbonate .....		0.89		
Iron bicarbonate .....	0.88			
Calcium sulphate .....		0.35	0.30	
Strontium sulphate .....	0.22			
Sodium nitrate .....	1.43			
Potassium nitrate .....	4.66			
Sodium chloride .....	12.87	0.27	0.19	
Magnesium chloride .....	6.72			
Calcium chloride .....	35.46			
Iron .....				
Alumina .....	1.86			
Loss .....		0.03	} 0.02 {	
Silicic acid .....	2.05	0.43		
Organic matter .....	Trace	0.91		
Magnesia .....				12.74
Lime .....				38.16
Sulphuric acid .....				71.68
Carbonic acid, chlorine, potash, and soda .....				51.42
Phosphoric acid, iodine, ammonia, and organic matter.	Trace			
Total .....	74.76	4.66	2.18	174.00
<i>Gases.</i>				
	<i>Cubic inches.</i>			
Oxygen .....	0.82			
Nitrogen .....	1.22			
Carbonic acid .....	3.50			

<sup>a</sup> W. Simon, analyst.

<sup>b</sup> W. E. A. Aiken, analyst (1867).

<sup>c</sup> Hector Humphrey and David Stewart, analysts.

## DISTRICT OF COLUMBIA.

A number of the wells and springs within the limits of the District are chalybeate; but none, even the strongest, is of much importance and the number is so small that no detailed list has been made.

At Uniontown, or Anacostia, opposite Washington, and also near Le Droit Park, in the northeastern part, chalybeate springs exist. A well on Louisiana avenue, between Ninth and Tenth streets, in Washington, is said to be quite strongly impregnated with iron. There are several other localities within the city limits that are said to have chalybeate springs or wells. No analyses have been made.

## VIRGINIA.

Virginia occupies the same position among the Southern Atlantic States that New York does among the Northern Atlantic States, in respect to both the number and the variety of her mineral springs. More than fifty localities are places of resort, some of them among the most famous in the country, and the waters of more than twenty are used commercially. Although the spring area proper is in the Appalachian region, mineral springs are also found in the more level country that stretches towards the coast from the foot of the Blue Ridge. Here the springs are largely chalybeate, as would naturally be expected. The thermal springs are confined to the mountain region. A large proportion of the springs are sulphureted, as is the case with so many springs in the adjoining States.

The literature of the Virginia springs is quite extensive. Prof. W. B. Rogers, in his geological report on the State, devotes considerable space to the mineral springs. Since his report a number of books have been published, among them those of Burke and of Moorman. These have all been consulted in the preparation of the following table. Boyd's *Resources of Southwestern Virginia*, published in 1881, has also furnished much information; but by far the greatest amount has been obtained in answer to circulars and letters sent to various portions of the State. Eighty-seven analyses are given in the table, the number of springs analyzed being seventy-five, which is only about one-quarter of the springs included in the list. This number is, however, slightly greater than the proportion in New York.

*Mineral springs in Virginia.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Alleghany Springs, Alleghany Spring, Montgomery County.	3	125	.....	Saline, calcic....	Used commercially and as a resort.
Alum Springs of Rockbridge County. Goshen Bridge, Rockbridge Co.	5	.....	.....	.....	Do.
Alum Well, 14 miles northwest of Abingdon, Washington County.	.....	.....	.....	.....	Local resort.
Amelia Springs, near Jetersville, Amelia County.	3	.....	.....	.....	Once a resort.
Bath Alum Springs, Bath Alum, Bath County.	8	.....	.....	Chalybeate.....	Used commercially and as a resort.
Bedford Alum and Iron Springs, Bedford Springs, Campbell County.	2	.....	56	.....do.....	Has been used commercially and as a resort.
Black Rock Springs, in Blue Ridge, Augusta County.	.....	.....	.....	.....do.....	Formerly frequented by private parties.
Blue Ridge Springs, Blue Ridge Springs, Botetourt County.	5	375	50 to 60	Saline, calcic....	Used commercially and as a resort.
Bolar Springs, 4 miles from Cleek's Mills, Bath County.	.....	.....	.....	.....	Unimproved.
Botetourt Springs (or Johnson's Springs), 8 miles east of Salem, Roanoke County.	.....	.....	.....	Sulphureted.....	Now the site of Holins Institute.
Buckingham White Sulphur Springs, 12 miles from Buckingham Court-House, Buckingham County.	2	120	.....	Saline, sulphureted, and chalybeate.	Resort.
Buffalo Lithia Springs, Buffalo Lithia Springs, Mecklenburg County.	3	180	65	Alkaline, calcic, and chalybeate.	Used commercially and as a resort.
Burner's Springs (Seven Springs), near Woodstock, Shenandoah Co.	7	.....	.....	.....	Resort.
Cecil's Alum Springs, Pulaski County	.....	.....	.....	.....	.....
Cedar Bluff Sulphur Springs, Cedar Bluff, Tazewell County.	2	16	.....	Sulphureted.....	Do.
Chilhowee or Holston Sulphur Springs, 10 miles southwest of Marion, Smyth County.	.....	.....	.....	.....	Local resort.
Church Hill Alum Springs, near Richmond, Henrico County.	.....	.....	.....	Chalybeate.....	.....
Cistern Lick Springs, 18 miles northeast of Warm Springs, Bath Co.	.....	.....	.....	.....	Very slightly improved.
Claypole's Chalybeate Spring, Burke's Garden, Tazewell County.	.....	.....	.....	.....	Used locally for medicinal purposes.
Clifton Springs, near Clifton Forge, Alleghany County.	4	.....	58 to 62	Alkaline, chalybeate.	Resort.
Cold Sulphur Springs, near Goshen Bridge, Rockbridge County.	2	300+	52	Saline, calcic....	Used to some extent commercially and as a resort.
Coyner's Sulphur Springs (post office address, Bonsack's, Roanoke Co.), Botetourt County.	5	75+	52 to 54	Sulphureted.....	Resort.
Crystal Sulphur Springs, 18 miles west of Staunton, Augusta County.	2	60	.....	.....do.....	Do.
Daggers or Dibrell Spring, Daggers, Botetourt County.	.....	.....	.....	.....do.....	Do.
Dickson's or Callaghan's Sulphur Spring, Callaghan's, Alleghany Co.	.....	.....	54	.....	.....
Dillard's Springs, near Ward's Springs, Pittsylvania County.	.....	.....	.....	Sulphureted.....	.....
Edmondson's Spring, or Lebanon White Sulphur Springs, Jennings Gap Road, Augusta County.	.....	.....	50 to 54	.....	.....
Falling Spring, 9 miles northeast of Covington, Alleghany County.	.....	.....	.....	.....	Unimproved.
Farmville Lithia Springs, Cumberland County, opposite Farmville, Prince Edward County.	16	*110	.....	Carbonated, saline.	Used commercially.
Fauquier White Sulphur Spring, Fauquier Springs, Fauquier Co.	1	175	56	Alkaline, carbonated.	Resort.
Grayson's Sulphur Springs, Carroll Co., 20 miles south of Wytheville.	4	.....	47 to 48	Sulphureted.....	Do.

\* Flow of four springs.

*Mineral springs in Virginia—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Hagan's Springs, near Clinch, Scott County.	3	2	49	Chalybeate and sulphureted.	Local resort.
Harrison's Mineral Spring, Tazewell County.	.....	.....	.....	Chalybeate	Used for medicinal purposes.
Healing Springs, Healing Springs, Bath County.	4	.....	85 to 88	Alkaline, calcic.	Used commercially and as a resort.
Holston Springs, 2 miles from Big Moccasin Gap, Scott County.	4	.....	61½ to 68½	Saline	.....
Hot Springs, Hot Springs, Bath Co.	20	.....	50 to 110	Saline, calcic.	Resort.
Huguenot Springs, Powhatan County, 17 miles from Richmond.	3	.....	.....	Sulphureted and chalybeate.	Do.
Iron Hill Springs, near Alleghany Station, Alleghany County.	6	.....	.....	.....	Was once a resort.
Jordan Alum Springs, near Rockbridge Alum Springs, Rockbridge County.	6	.....	52½ to 58.2	Chalybeate	Resort.
Jordan's White Sulphur Springs, 1½ miles from Stephenson Depot, Frederick County.	2	.....	57	Sulphureted and chalybeate.	Used commercially and as a resort.
Kern's Springs, 6 miles northwest of Woodstock, Shenandoah County.	6	.....	.....	Chalybeate	Used locally as a resort.
Kimberling Springs, Bland County, 28 miles from Wytheville.	.....	.....	.....	.....	Local resort.
Liberty Springs, 2½ miles northwest of Rawley Springs, Rockingham Co.	.....	.....	.....	.....	Resort.
Lithia Springs, 3 miles southwest of Abingdon, Washington County.	.....	.....	.....	.....	Unimproved.
Lone Fountain, Augusta County	.....	.....	.....	.....	Used locally.
Magnesia Springs, Ash Grove, near Great Falls of Potomac, Fairfax Co.	4	400	60	Chalybeate	Unimproved.
Massanetta Mineral Springs (formerly Taylor's Springs), near Harrisonburg, Rockingham County.	2	30,000+	60	Calcic, alkaline	Used commercially and as a resort.
McHenry's Thermal Spring, Scott Co.	.....	.....	68	.....	.....
Millborough Springs, Millborough Springs, Bath County.	2	.....	48 to 60	Sulphureted and chalybeate.	Resort.
<i>Mineral springs:</i>					
Eight miles from Wytheville Springs (Cove Lithia Springs), Wythe County.	.....	.....	.....	.....	Do.
Near Mandota, Washington County.	5	.....	.....	Sulphureted and chalybeate.	Unimproved.
Near Beech Spring, Lee County.	3	.....	.....	do	.....
Poor Valley, 9 miles northwest of Jonesville, Lee County.	3	.....	.....	.....	.....
Three miles north of Jonesville, Lee County.	2	75	.....	.....	Used locally.
Near Farmwell Station, Loudoun County.	3	.....	.....	.....	Unimproved.
At Giggett's, near Palmer's Springs, Mecklenburg Co.	.....	.....	.....	.....	Do.
Montgomery White Sulphur Springs, Montgomery Springs, Montgomery County.	.....	.....	.....	Sulphureted	Resort.
Mungel's Springs, 9 miles northwest of Abingdon, Washington County.	4	70	.....	Sulphureted and chalybeate.	Do.
Mustard's Mineral Springs, near Witten's Mills, Tazewell County.	.....	.....	.....	Sulphureted	Used for medicinal purposes.
New River White Sulphur Springs (Eggleston Springs), near Staytide, Giles County.	3	150	85	do	Resort.
Orkney Springs, Orkney Springs, Shenandoah County.	23	572+	58.6-59.7	Alkaline, calcic.	Do.
Palmer's Springs, Palmer's Springs, Mecklenburg County.	2	.....	.....	.....	Used locally.
Powhatan Lithia and Alum Springs, near Ballsville, Powhatan County.	4	.....	64	Chalybeate, &c.	Used commercially.
Preston's Spring, Montgomery Co.	.....	.....	54	.....	.....
Pulaski Alum Springs, Dublin, Pulaski County.	3	.....	58	Chalybeate	Used commercially and as a resort.
Rawley Springs, Rawley Springs, Rockingham County.	3	178	51.8-54.6	do	Do.

*Mineral springs in Virginia — Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Roanoke Red Sulphur Springs, near Salem, Roanoke County.	4	1,278	53 to 60	Sulphureted and chalybeate.	Resort.
Rockbridge Alum Springs, Rockbridge County.	4	.....	50 to 56	Chalybeate .....	Used commercially and as a resort.
Rockbridge Baths, Rockbridge County.	.....	.....	74	Alkaline .....	Resort.
Rock Enon Springs (Capper's), Rock Enon Springs, Frederick County.	8	.....	.....	Alkaline and saline, chalybeate and sulphureted.	Used commercially and as a resort.
Rockingham Virginia Springs, near McGaheysville, Rockingham Co.	10	730	40 to 58	Saline, chalybeate.	Do.
Seven Springs, near Abingdon, 2 miles from Glade Spring Depot, Washington County.	7	.....	.....	Chalybeate .....	Used commercially.
Sharon Springs, Sharon Springs, Bland County.	3	.....	.....	do .....	Resort.
Shenandoah Alum Springs, Shenandoah Alum Springs, Shenandoah Co.	10	157	56 to 70	do .....	Used commercially and as a resort.
Silcott's Springs, Silcott Springs, Loudoun County.	1	.....	.....	do .....	Unimproved.
Snake Run Spring, 20 miles southwest of Covington, Alleghany Co.	.....	.....	.....	do .....	Resort.
Stafford Springs, Stafford Store, Stafford County.	.....	.....	.....	.....	Used to some extent; has been unimproved for a long time.
Stribling or Augusta Springs, Stribling Springs, Augusta County.	6	.....	.....	.....	Used commercially and as a resort.
Sudley Springs, Sudley Springs, Prince William County.	2	52+	53	Chalybeate .....	Once a resort.
Sulphur Spring, Russell County, 24 miles northwest of Abingdon.	1	.....	.....	.....	Unimproved.
Sulphur and Chalybeate Springs, near Beech Spring, Lee County.	3	.....	.....	.....	.....
Sweet Chalybeate Springs (Red Sweet Springs), Sweet Chalybeate, Alleghany County.	4	800+	75 to 79	Calcic, chalybeate.	Resort.
Tally's Springs, 2 miles from Palmer's Springs, Mecklenburg Co.	.....	.....	.....	.....	Has a local reputation.
Tazewell Sulphur Springs, 5 miles northwest of Jeffersonville, Tazewell County.	4	.....	.....	Sulphureted .....	Was a resort prior to the war.
Union Springs, 3 miles south of Rawley Springs, Rockingham County.	.....	.....	.....	.....	.....
Valley View Springs, near Newmarket, Shenandoah County.	.....	.....	.....	Sulphureted, chalybeate.	Resort.
Variety Springs, near Pond Gap, Augusta County.	4	160+	.....	Chalybeate, &c.	Do.
Wallawhatoola Alum Springs, 3½ miles from Millboro Depot, Bath County.	2	75+	56	Saline, chalybeate.	Used commercially and as a resort.
Warm Sulphur Springs, Warm Springs, Bath County.	.....	360,000	96 to 98	Calcic .....	Resort.
Washington Springs, near Glade Spring, Washington County.	.....	.....	.....	Chalybeate .....	Do.
Wayland Spring, near Jennings' Ordinary, Nottoway County.	.....	.....	.....	do .....	Local resort.
White Sulphur Spring, Big Stone Gap, Wise County.	1	.....	.....	.....	Used to a limited extent as a resort.
White Sulphur Springs, Tazewell Co.	.....	.....	.....	.....	.....
Wilson's Thermal Spring .....	.....	.....	.....	.....	Probably same as Daggers Spring.
Wolf Trap, Lithia Springs (well), Wolf Trap, Halifax Co.	.....	.....	59	Alkaline, calcic.	Used commercially.
Wytheville Springs, Wytheville, Wythe County.	.....	.....	.....	Chalybeate .....	Resort.
Yellow Sulphur Springs, near Christiansburg, Montgomery County.	.....	150	55	Calcic, saline, sulphur.	Do.

*Analyses of mineral springs in Virginia.*

Constituents.	Alleghany Springs.	Bath Alum Springs.				Clifton Springs.	
		Spring No. 1.	Spring No. 2.	Spring No. 3.	Cave Springs.	Spring No. 1.	Spring No. 2.
	<i>Grains per gall.<sup>a</sup></i>	<i>Grains per gall.<sup>b</sup></i>	<i>Grains per gall.<sup>c</sup></i>	<i>Grains per gall.<sup>b</sup></i>	<i>Grains per gall.<sup>c</sup></i>	<i>Grs. per imp. gall.<sup>d</sup></i>	<i>Grs. per imp. gall.<sup>d</sup></i>
Calcium carbonate	3.61						
Calcium bicarbonate					0.69		
Magnesium carbonate	0.36						
Magnesium bicarbonate					1.98		
Lithium carbonate	Trace						
Strontium carbonate	0.06						
Barium carbonate	0.02						
Manganese carbonate	0.06						
Manganese bicarbonate					0.64		
Iron carbonate	0.16						
Iron bicarbonate					2.18		
Cobalt carbonate	Trace						
Zinc carbonate	Trace						
Copper carbonate	Trace						
Lead carbonate	Trace						
Sodium sulphate	1.72		1.13		0.30		
Calcium sulphate	115.29	3.80	1.71		0.32		
Lithium sulphate			Trace		Trace		
Magnesium sulphate	50.88	2.82	0.46				
Potassium sulphate	3.70		0.34	0.26	0.17		
Aluminium sulphate			29.99		0.02		
Ammonium sulphate			Trace				
Manganese sulphate			0.03				
Iron persulphate			26.78				
Magnesium nitrate	3.22						
Ammonium nitrate	0.56						
Calcium phosphate					Trace		
Aluminium phosphate	0.03			3.15			
Sodium silicate		2.02					
Aluminium silicate	0.21						
Ammonium crenate		1.85		1.77			
Sodium chloride	0.28	0.17	0.11				
Calcium chloride					0.06		
Calcium fluoride	0.02						
Soda						0.584	4.182
Magnesia				1.28		0.325	3.202
Potash						0.153	0.648
Lime						1.226	21.830
Lithia						Trace	Trace
Antimonyum teroxide	Trace						
Iron oxide		14.52		21.77		1.109	Trace
Manganese protoxide						Trace	
Alumina		10.29		12.29		0.076	
Silica	0.88		1.95		0.45	0.728	1.177
Chlorine						0.052	0.765
Phosphoric acid							Trace
Sulphuric acid		5.81	2.88	7.88		0.721	2.236
Carbonic acid		4.14		3.85		2.069	22.373
Crenic acid	Trace						
Apocrenic acid	Trace			2.54			
Organic acid						0.422	
Organic matter	2.00						Trace
Oxygen added to sodium		0.02					
Total	183.06	45.44	65.38	54.79	6.81		
<i>Gases.</i>							
Carbonic acid	4.56	4.652				<i>Cu. in.</i> 6.013	<i>Cu. in.</i> 5.018
Sulphureted hydrogen	Trace						
Oxygen						1.847	} 10.210
Nitrogen						3.955	

<sup>a</sup> F. A. Genth, analyst.<sup>b</sup> Hayes, analyst.<sup>c</sup> W. H. Taylor, analyst.<sup>d</sup> J. L. Campbell, analyst (1877).<sup>e</sup> With ammonia.

## Analyses of mineral springs in Virginia—Continued.

Constituents.	Bedford Alum and Iron Springs.		Blue Ridge Springs.	Buffalo Lithia Springs.			Cold Sulphur Springs.
				Spring No. 1.	Spring No. 2.	Spring No. 3.	
<i>Solids.</i>	<i>Grains per gall.<sup>a</sup></i>	<i>Grains per gall.<sup>b</sup></i>	<i>Grains per gall.<sup>c</sup></i>	<i>Grains pr. imp. gall.<sup>d</sup></i>	<i>Grains pr. imp. gall.<sup>d</sup></i>	<i>Grains pr. imp. gall.<sup>d</sup></i>	<i>Grains per gall.</i>
Calcium bicarbonate .....			5.44	39.28	14.96	2.52	1.84
Magnesium carbonate .....			3.01				1.78
Magnesium bicarbonate .....							
Potassium carbonate .....					29.30	1.85	
Lithium bicarbonate .....				1.45	2.25		
Barium bicarbonate .....					1.75		
Iron carbonate .....							0.02
Iron bicarbonate .....			0.41	0.50	0.30	3.77	
Sodium sulphate .....	0.87		0.97				2.46
Calcium sulphate .....	4.99	18.67	100.22	19.25	33.07	2.35	2.91
Lithium sulphate .....	0.24						
Magnesium sulphate .....	12.58	12.66	47.56	1.53	0.89	0.15	0.29
Potassium sulphate .....	0.71	10.16	0.40	0.46			
Aluminium sulphate .....	24.18	7.24		8.18	9.07	3.04	0.25
Manganese sulphate .....	0.19						
Iron protosulphate .....	0.59	23.46					
Iron persulphate .....	19.26						
Nickel sulphate .....	0.04						
Cobalt sulphate .....	0.06						
Copper sulphate .....	0.06						
Zinc sulphate .....	0.07						
Magnesium nitrate .....	0.27						
Ammonium nitrate .....	0.24						
Calcium phosphate .....	0.30						
Phosphates .....							Trace
Sodium silicate .....							1.48
Sodium chloride .....	0.23		0.25	1.26	4.92	0.22	
Calcium chloride .....							0.12
Calcium fluoride .....	Trace						
Lithia .....						Trace	
Alumina .....			0.14				
Silica .....	1.69		1.26	1.72	1.87	0.57	
Iodine .....				Trace	Trace		
Phosphoric acid .....				Trace	Trace	Trace	
Sulphuric acid .....	4.02	19.98					
Organic matter .....	0.29			Trace	Trace	Trace	0.32
Total .....	70.88	92.17	159.66	73.66	98.38	14.47	11.47
<i>Gases.</i>							
Carbonic acid .....				<i>Cubic in.</i>	<i>Cubic in.</i>	<i>Cubic in.</i>	
Sulphureted hydrogen .....				69.1	59.2	11.6	
Oxygen .....	1.32			5.9	8.3	3.4	
Nitrogen .....	3.33						
Carbon dioxide .....	6.98						

<sup>a</sup> M. B. Hardin, analyst (1877).<sup>b</sup> William Gilham, analyst.<sup>c</sup> F. A. Genth, analyst.<sup>d</sup> W. P. Tonry, analyst (1874).

*Analyses of mineral springs in Virginia—Continued.*

Constituents.	Church Hill Alum Springs.	Farmville Lithia Springs, No. 2.	Fauquier White Sulphur Spring.	Dickson's Sulphur Spring.	McHenry's Thermal Spring.	Wilson's Thermal Spring.
	Grains per gallon. <sup>a</sup>	Grains per gallon. <sup>b</sup>	Grains per gallon. <sup>c</sup>	Grains in 200 cu. in. <sup>d</sup>	Grains in 100 cu. in. <sup>d</sup>	Grains in 100 cu. in. <sup>d</sup>
Sodium carbonate	.....			2.26		
Calcium carbonate	.....			2.48	6.34	5.00
Calcium bicarbonate	.....	1.33	7.88			
Magnesium carbonate	.....			1.50	1.54	0.52
Magnesium bicarbonate	.....	4.49	2.47			
Lithium carbonate	.....	1.99				
Manganous carbonate	.....	Trace				
Ferrous carbonate	.....	1.26				
Sodium sulphate	1.94	3.59			3.77	3.53
Calcium sulphate	88.83	1.81	3.39		7.83	8.09
Magnesium sulphate	86.07				0.25	1.30
Potassium sulphate	2.44	0.18	1.63			
Aluminium persulphate	72.93					
Ammonium sulphate	0.64					
Iron sulphate	.....		2.14			
Iron bisulphate	83.35					
Iron protosulphate	24.18					
Iron persulphate	51.26					
Sodium chloride	4.62	5.30	3.75	0.05	0.68	Little
Magnesium chloride	.....					
Calcium chloride	.....			Trace		
Potassium chloride	.....					
Calcium and magnesium phosphate.	.....		0.64			
Iron peroxide	.....			0.03	Trace	Trace
Alumina	.....	2.52				
Silica	10.43	3.92		0.96		(s)
Iodine	.....	Trace				
Phosphoric acid	Trace					
Sulphuric acid	.....	Trace				
Organic matter	.....	Trace		Little	Little	(s)
Gaseous matter, &c.	.....		0.10			
Loss	.....			0.19		
Total	426.69	26.39	22.00	7.47	20.41	22.85
<i>Gases.</i>						
Carbonic acid	.....	Cubic in. 74.2	Cubic in. 11.00		Undetermined	Undetermined
Sulphureted hydrogen	.....		Little			

Constituents.	Edmondson's Spring.	Holston Springs.	Mineral Springs near Farmwell Station.		Healing Springs.	
			No. 1.	No. 3.	Old Spring.	New Spring.
	Grains in 200 cu. in. <sup>d</sup>	Grains per gallon. <sup>b</sup>	Grams per liter. <sup>f</sup>	Grams per liter. <sup>f</sup>	Grains per gallon. <sup>j</sup>	Grains per gallon. <sup>j</sup>
Sodium carbonate	1.32					
Calcium carbonate	2.77	6.40	0.1319	0.1107	17.90	18.72
Calcium bicarbonate	.....		0.1100	0.1438		
Magnesium carbonate	(s)				1.25	1.96
Iron carbonate	.....				0.07	0.28
Sodium sulphate	Trace	Trace	0.2355	0.2543		
Calcium sulphate	.....	20.48	1.5052	1.6363	1.32	1.26
Magnesium sulphate	.....	12.72	0.0750	0.0975	7.25	7.39
Potassium sulphate	.....				2.21	2.53
Aluminium sulphate	.....	Trace				
Ammonium sulphate	.....				0.23	0.23
Iron sulphate	.....				0.18	0.10
Aluminium phosphate	.....	Trace				
Sodium chloride	0.12	1.52	0.0104	0.0244	0.27	2.89
Potassium chloride	.....		0.0067	0.0057	0.24	0.25
Iron peroxide	(s)					
Alumina	.....		0.0070	0.0105		
Silica	(s)		0.0210	0.0110	1.89	1.82
Bromine	.....				Trace	Trace
Iodine	.....				Trace	Trace
Carbonic acid	.....				2.20	2.29
Organic acid	.....				0.86	0.88
Organic matter	(s)					
Loss	.....		0.0040			
Sulphureted hydrogen	.....				Trace	Trace
Total	7.38	41.12	2.1067	2.2942	34.87	40.60

<sup>a</sup> J. C. Booth, analyst.<sup>b</sup> E. T. Fristoe, analyst (1879).<sup>c</sup> Thomas Antisell, analyst (1878).<sup>d</sup> W. B. Rogers, analyst.<sup>e</sup> With sodium sulphate.<sup>f</sup> With iron phosphate.<sup>g</sup> Quantities not given.<sup>h</sup> Hayden, analyst.<sup>i</sup> R. B. Riggs, analyst (1886).<sup>j</sup> W. E. Aiken, analyst (1868).<sup>k</sup> With ammonium chloride.

## Analyses of mineral springs in Virginia—Continued.

Constituents.	Hot Springs.				
	Boiler Bath (Old Ladies' Boiler Bath).	Hot Spout Bath.	Octagon Bath.	New Hot Spring.	Sulphur Bath or Ladies' Sul- phur Bath.
	<i>Gram per liter.<sup>a</sup></i>	<i>Gram per liter.<sup>a</sup></i>	<i>Gram per liter.<sup>a</sup></i>	<i>Gram per liter.<sup>a</sup></i>	<i>Gram per liter.<sup>a</sup></i>
Calcium carbonate .....	0.2355	0.2390	0.2340	0.2272	0.2355
Magnesium carbonate .....	0.1249	0.1201	0.1218	0.1228	0.1155
Sodium sulphate .....	0.0370	0.0281	0.0296	0.0278	0.0420
Calcium sulphate .....	0.1407	0.1424	0.1504	0.1401	0.1278
Potassium sulphate .....	0.0138	0.0187	0.0185	0.0212	0.0158
Potassium chloride .....	0.0105	0.0092	0.0086	0.0061	0.0068
Alumina .....	0.0020	0.0025	0.0035	0.0060	0.0065
Silica .....	0.0275	0.0235	0.0255	0.0235	0.0230
Bromine .....	Trace	Trace	.....	.....	.....
Loss .....	0.0056	0.0090	0.0021	.....	0.0046
Total .....	0.5975	0.5925	0.5940	0.5747	0.5775

  

Constituents.	Hot Springs.				
	Magnesian Spring.	Boiler Spring or Ladies' Boiler Bath.		Ladies' Sul- phur Bath.	Gentlemen's Pleasure Bath or Magnesia Spring.
	<i>Gram per liter.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
<i>Solids.</i>					
Calcium carbonate .....	0.1845	17.40	17.34	16.44	9.48
Magnesium carbonate .....	0.0731	.....	2.68	2.80	2.02
Iron carbonate .....	.....	.....	0.11	0.06	0.08
Sodium sulphate .....	0.0201	3.64	1.02	1.01	0.85
Calcium sulphate .....	0.0744	5.48	1.74	2.10	3.02
Magnesium sulphate .....	.....	2.05	5.66	5.10	1.06
Potassium sulphate .....	0.0109	.....	1.35	1.82	0.57
Sodium chloride .....	.....	1.33	0.12	0.14	0.13
Potassium chloride .....	0.0042	.....	1.60	0.17	0.16
Silica .....	0.0120	0.18	1.74	1.37	0.69
Loss .....	0.0033	.....	.....	.....	.....
Total .....	0.3825	30.08	33.36	31.01	18.09
<i>Gases.</i>		<i>Cubic inches in 100 cu. in.</i>			
Carbonic acid .....	.....	11.007	.....	.....	.....
Sulphureted hydrogen .....	.....	Trace	.....	.....	.....
Oxygen .....	.....	0.220	.....	.....	.....
Nitrogen .....	.....	1.790	.....	.....	.....

\*F. W. Clarke, analyst (1884).

\*W. B. Rogers, analyst.

\*William Gilham, analyst (1866).

*Analyses of mineral springs in Virginia—Continued.*

Constituents.	Jordan Alum Springs.						
	Chalybeate Spring.	Alum Spring.	Spring No. 2.	Spring No. 3.	Spring No. 4.	Spring No. 5.	Spring No. 6.
<i>Solids.</i>	<i>Grains per gall.<sup>a</sup></i>	<i>Grains per gall.<sup>b</sup></i>	<i>Grains per gall.<sup>a</sup></i>	<i>Grains per gall.<sup>a</sup></i>	<i>Grains per gall.<sup>a</sup></i>	<i>Grains per gall.<sup>a</sup></i>	<i>Grains per gall.<sup>a</sup></i>
Magnesium carbonate.....	0.74	.....	.....	.....	.....	.....	.....
Manganese carbonate.....	0.04	.....	.....	.....	.....	.....	.....
Iron carbonate.....	0.70	.....	.....	.....	.....	.....	.....
Sodium sulphate.....	0.14	0.17	0.25	0.19	0.23	0.32	0.24
Calcium sulphate.....	3.71	4.44	0.32	0.29	3.31	3.01	1.84
Lithium sulphate.....	.....	.....	Trace	Trace	0.02	0.01	0.01
Magnesium sulphate.....	.....	5.18	3.15	2.65	9.22	5.37	8.21
Potassium sulphate.....	0.13	1.31	0.32	0.25	0.27	0.30	0.33
Aluminium sulphate.....	.....	25.38	11.20	6.88	81.05	26.11	27.85
Manganese sulphate.....	.....	.....	0.12	0.30	1.02	0.57	0.53
Iron sulphate.....	.....	18.54	1.43	1.84	.....	.....	.....
Iron protosulphate.....	.....	.....	0.30	0.23	0.52	0.22	0.32
Iron persulphate.....	.....	.....	.....	.....	5.17	2.43	2.87
Nickel sulphate.....	.....	.....	0.10	0.13	0.46	0.26	0.41
Cobalt sulphate.....	.....	.....	0.08	0.09	0.32	0.31	0.31
Copper sulphate.....	.....	.....	0.12	0.11	6.08	2.33	3.10
Zinc sulphate.....	.....	.....	0.07	0.03	0.61	0.22	0.28
Cadmium sulphate.....	.....	.....	Trace	Trace	0.03	Trace	0.01
Calcium phosphate.....	0.02	.....	Trace	Trace	0.01	0.01	Trace
Iron phosphate.....	.....	0.25	.....	.....	.....	.....	.....
Sodium silicate.....	.....	2.51	.....	.....	.....	.....	.....
Ammonium crenate.....	.....	0.53	.....	.....	.....	.....	.....
Iron crenate.....	.....	0.68	.....	.....	.....	.....	.....
Sodium chloride.....	0.11	0.73	0.01	0.01	0.08	0.06	0.04
Calcium fluoride.....	.....	.....	Trace	Trace	Trace	Trace	Trace
Sodium iodide.....	0.01	0.70	.....	.....	.....	.....	.....
Alumina.....	0.05	.....	.....	.....	.....	.....	.....
Silica.....	0.72	.....	2.00	2.80	3.03	3.30	3.42
Sulphuric acid.....	.....	23.64	2.07	2.14	4.84	7.90	5.32
Organic matter.....	0.09	0.58	Trace	Trace	Trace	Trace	Trace
Total.....	6.46	84.64	21.54	17.94	116.27	52.73	55.09
<i>Gases.</i>	<i>Cubic in.</i>	<i>Cubic in.</i>	<i>Cubic in.</i>	<i>Cubic in.</i>	<i>Cubic in.</i>	<i>Cubic in.</i>	<i>Cubic in.</i>
Carbonic acid.....	5.60	6.16	11.22	11.39	10.38	9.91	11.08
Oxygen.....	1.60	.....	1.33	1.27	1.11	1.35	1.62
Nitrogen.....	8.56	.....	3.76	3.62	3.19	3.33	4.04

<sup>a</sup> J. W. Mallet (1873).<sup>b</sup> William E. A. Aiken (1873).

*Analyses of mineral springs in Virginia—Continued.*

Constituents.	Jordan's White Sulphur Springs.	Kimberling Springs, red sulphur Spring.	Massanetta Mineral Springs.	Pulaski Alum Springs.	Rawley Springs, main fountain.
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per imp. gallon.<sup>e</sup></i>
Sodium carbonate.....		6.21	1.13		
Calcium carbonate.....		0.72	14.78		
Magnesium carbonate.....	2.88	1.62	6.95		
Potassium carbonate.....	9.71	0.75			
Manganese carbonate.....	0.01		0.05		
Iron carbonate.....	Trace		0.38		
Calcium sulphate.....	5.13	2.32	0.42	1.58	
Magnesium sulphate.....				1.87	
Potassium sulphate.....	2.09		0.11	0.83	
Aluminium sulphate.....				21.59	
Iron sulphate.....				108.75	
Soluble silicates.....				0.84	
Sodium chloride.....	0.76	0.42		0.56	
Potassium chloride.....			0.16		
Ammonium chloride.....			0.01		
Soda.....					0.31
Magnesia.....					0.39
Potash.....					0.07
Lime.....					0.35
Lithia.....			Trace		Trace
Ammonia.....					Trace
Iron.....		Trace			
Iron peroxide.....					1.32
Manganese protoxide.....					0.01
Arsenious oxide.....			Trace		
Alumina.....	0.01		0.16		0.05
Silica.....	0.25	0.67	0.13		0.82
Chlorine.....					0.03
Phosphoric acid.....			Trace		
Sulphuric acid.....		0.17		1.94	0.52
Sulphureted hydrogen.....	0.79				
Carbonic acid (combined)					1.56
Organic matter.....		2.16	0.48		0.35
Total.....	21.63	15.04	25.76	137.96	5.78
<i>Gases.</i>					
Carbonic acid.....			2.64		<i>Cubic inches.</i> 7.24
Oxygen.....			8.44		2.07
Nitrogen.....					4.18
Carbureted hydrogen.....			2.25		

<sup>a</sup> Thos. Antisell, analyst (1871).<sup>b</sup> D. K. Tuttle, analyst.<sup>c</sup> J. W. Mallet, analyst.<sup>d</sup> J. L. Campbell, analyst (1870).<sup>e</sup> J. W. Mallet, analyst (1878).<sup>f</sup> With soda.

*Analyses of mineral springs in Virginia—Continued.*

Constituents.	Orkney Springs.			Rockbridge Alum Springs.		
	Healing Spring.	Powder Spring.	Bear Wal-low Spring.	Chalybeate Spring.	Spring No. 1.	
	Grains per imp. gall. <sup>a</sup>	Grains per imp. gall. <sup>a</sup>	Grains per imp. gall. <sup>a</sup>	Grains per gall. <sup>b</sup>	Grains per gall. <sup>c</sup>	Grains per gall. <sup>d</sup>
Sodium carbonate .....	0.02	3.91				
Calcium carbonate .....	9.93	4.59				
Magnesium carbonate .....	1.36	3.54		0.89		
Lithium carbonate .....	Trace	Trace		Trace		
Manganese carbonate .....	Trace	0.02		0.05		
Iron carbonate .....	0.56	0.26		0.85		
Sodium sulphate .....						0.02
Calcium sulphate .....	1.38	0.11	0.86	4.46	1.44	1.73
Lithium sulphate .....			0.07			0.02
Magnesium sulphate .....			2.94		1.08	0.89
Potassium sulphate .....	0.23	0.19	0.25	0.16		0.17
Strontium sulphate .....		Trace				
Barium sulphate .....		Trace				
Aluminium sulphate .....	0.03	0.02	0.06			31.25
Manganese sulphate .....			0.02			0.86
Iron sulphate .....			5.45			
Iron persulphate .....						1.02
Nickel sulphate .....						0.06
Cobalt sulphate .....						0.03
Copper sulphate .....		Trace	Trace			
Zinc sulphate .....						0.12
Lead sulphate .....					Trace	Trace
Ammonium nitrate .....						Trace
Calcium phosphate .....	0.01	Trace	0.01	0.02		0.02
Sodium silicate .....					2.55	
Ammonium crenate .....					1.40	
Sodium sulphide .....		0.53				
Sodium chloride .....	0.15	0.43	0.11	0.14	0.42	0.08
Potassium chloride .....	0.04	0.03	0.08			
Ammonium chloride .....		Trace	Trace			
Calcium fluoride .....	Trace					Trace
Sodium iodide .....			Trace			
Antimony .....						Trace
Copper .....				Trace		0.04
Iron protoxide .....					3.68	
Iron .....						
Arsenic .....		Trace	Trace	Trace		Trace
Alumina .....				0.06	14.76	
Silica .....	1.00	1.66	1.85	0.87		3.54
Nitric acid .....				Trace		
Sulphuric acid .....			0.43		18.79	3.24
Carbonic acid .....					2.62	
Carbonic anhydride .....	5.39	5.60				
Organic matter .....		Trace	0.07	0.11		Trace
Total .....	20.10	20.89	12.20	7.61	46.74	43.09
<i>Gases.</i>	<i>Cub. inches.</i>	<i>Cub. inches.</i>	<i>Cub. inches.</i>	<i>Cub. inches.</i>	<i>Cub. inches.</i>	<i>Cub. inches.</i>
Sulphureted hydrogen .....		5.91				
Oxygen .....	1.64		0.46			1.53
Nitrogen .....	3.05	2.85	1.52			4.19
Carbon dioxide .....	4.64	8.62	5.78			12.37

<sup>a</sup>J. W. Mallet, analyst (1875).<sup>b</sup>J. W. Mallet, analyst.<sup>c</sup>A. A. Hayes, analyst.<sup>d</sup>M. B. Hardin, analyst (1873).

## Analyses of mineral springs in Virginia—Continued.

Constituents.	Rockbridge Alum Springs.					
	Spring No. 2.		Spring No. 3.	Spring No. 4.		
	Grains per gallon. <sup>a</sup>	Grains per gallon. <sup>b</sup>	Grains per gallon. <sup>b</sup>	Grains per gallon. <sup>c</sup>	Grains per gallon. <sup>b</sup>	Grains per gallon. <sup>d</sup>
Sodium sulphate.....		0.03	0.02		0.03	0.01
Calcium sulphate.....	3.26	3.23	2.64	3.26	2.32	0.35
Lithium sulphate.....		0.02	0.02		0.03	0.02
Magnesium sulphate.....	1.76	5.61	6.37	4.42	7.36	1.50
Potassium sulphate.....	1.76	0.41	0.38		0.18	0.06
Aluminium sulphate.....		42.61			72.37	19.00
Manganese sulphate.....		0.09	0.53		1.37	0.52
Iron protosulphate.....						0.88
Iron persulphate.....		1.95	1.76		2.90	Trace
Nickel sulphate.....		0.14	0.24		0.23	0.05
Cobalt sulphate.....		0.02	0.08		0.08	0.04
Copper sulphate.....						Trace
Zinc sulphate.....		0.39	0.21		0.22	0.05
Lead sulphate.....		Trace	Trace		Trace	
Ammonium nitrate.....		Trace	Trace		Trace	Trace
Calcium phosphate.....		0.17	0.20		0.05	Trace
Ammonium crenate.....	0.70			1.22		
Sodium chloride.....	1.01	0.11	0.11	0.44	0.14	0.14
Calcium fluoride.....		Trace	Trace		Trace	Trace
Antimony.....		Trace	Trace		Trace	Trace
Copper.....		0.04	0.09		0.10	
Iron oxide.....	4.86					
Arsenic.....		Trace	Trace	4.69		
Alumina.....	17.91				Trace	
Silica.....	2.84	3.70	43.95	24.09		
Sulphuric acid.....	15.22	3.83	3.13	1.71	4.38	1.93
Carbonic acid.....	7.36		2.04	5.51	3.07	2.54
Organic matter.....		Trace	Trace	4.20		
Total.....	56.68	62.35	61.77	50.56	94.83	27.09
<b>Gases.</b>						
Oxygen.....	<i>Cub. inches.</i>	<i>Cub. inches.</i>	<i>Cub. inches.</i>	<i>Cub. inches.</i>	<i>Cub. inches.</i>	<i>Cub. inches.</i>
Nitrogen.....		1.49	1.65		4.12	
Carbon dioxide.....		3.98	4.10		1.64	
		10.89	11.95		12.72	

## Constituents.

## Rockbridge Alum Springs.

Spring No. 5.      Spring No. 6.      Spring No. 7.      Spring No. 8.      Spring No. 9.

## Solids.

	Grains per gallon. <sup>a</sup>	Grains per gallon. <sup>c</sup>	Grains per gallon. <sup>c</sup>	Grains per gallon. <sup>c</sup>	Grains per gallon. <sup>f</sup>
Sodium sulphate.....	0.24	0.18	0.23	0.32	0.24
Calcium sulphate.....	0.32	0.29	3.31	3.02	1.84
Lithium sulphate.....	Trace	0.01	0.02	0.01	0.01
Magnesium sulphate.....	3.15	2.65	9.22	5.36	8.21
Potassium sulphate.....	0.32	0.25	0.27	0.30	0.33
Aluminium sulphate.....	11.20	6.88	81.05	26.11	27.85
Manganese sulphate.....	0.13	0.31	1.03	0.57	0.53
Iron protosulphate.....	0.29	0.23	0.52	0.23	0.32
Iron persulphate.....	1.43	1.84	5.17	2.43	2.87
Nickel sulphate.....	0.10	0.12	0.46	0.26	0.41
Cobalt sulphate.....	0.08	0.09	0.31	0.31	0.31
Copper sulphate.....	0.12	0.11	6.08	2.33	3.10
Zinc sulphate.....	0.07	0.03	0.61	0.21	0.28
Cadmium sulphate.....	Trace	Trace	0.03	Trace	Trace
Calcium phosphate.....	Trace	Trace	0.01	0.01	0.01
Sodium chloride.....	0.01	0.01	0.08	0.06	0.04
Calcium fluoride.....	Trace	Trace	Trace	Trace	Trace
Silica.....	2.00	2.80	3.03	3.30	3.42
Sulphuric acid.....	2.07	2.14	4.84	7.90	5.32
Organic matter.....	Trace	Trace	Trace	Trace	Trace
Total.....	21.53	17.94	116.27	52.73	55.09

## Gases.

	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Oxygen.....	1.33	1.27	1.11	1.35	1.63
Nitrogen.....	3.76	3.62	3.19	3.33	4.04
Carbon dioxide.....	11.22	11.39	10.38	9.91	11.08
Marsh gas.....				Trace	

<sup>a</sup> A. A. Hayes, analyst.<sup>b</sup> M. B. Hardin, analyst (1873).<sup>c</sup> A. A. Hayes, analyst (1832).<sup>d</sup> M. B. Hardin, analyst (1872).<sup>e</sup> J. W. Mallet, analyst.<sup>f</sup> J. W. Mallet, analyst (1873.)

*Analyses of mineral springs in Virginia—Continued.*

Constituents.	Stribling or Augusta Springs.			
	No. 2 Sulphur Spring.	No. 1 Chalybeate Spring.	Sulphur Spring.	Alum Spring.
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>b</sup></i>
Sodium carbonate .....	6.24	0.76	1.20	.....
Calcium carbonate .....	9.63	1.50	5.52	.....
Magnesium carbonate .....	2.01	0.98	3.87	.....
Potassium carbonate .....	0.74	0.35	.....	.....
Iron carbonate .....	0.13	0.07	.....	.....
Sodium sulphate .....	.....	.....	0.81	.....
Calcium sulphate .....	1.25	0.22	.....	6.88
Magnesium sulphate .....	.....	.....	.....	3.37
Potassium sulphate .....	.....	.....	0.44	1.32
Aluminium bisulphate .....	.....	.....	.....	16.68
Iron sulphate .....	.....	.....	.....	12.13
Calcium phosphate .....	.....	.....	Trace	.....
Sodium silicate .....	.....	.....	0.25	.....
Ammonium crenate .....	.....	.....	.....	0.63
Sodium chloride .....	0.64	.....	0.61	0.64
Silica .....	0.64	1.33	.....	1.55
Sulphuric acid .....	.....	.....	.....	9.09
Carbonic acid .....	.....	.....	3.90	3.57
Organic matter .....	.....	.....	1.23	.....
Total .....	21.28	5.21	17.83	55.56
<i>Gases.</i>				
Carbonic acid .....	10.40	24.00	.....	.....
Sulphureted hydrogen .....	0.24	.....	0.91	.....

Constituents.	Stribling or Augusta Springs.			
	No. 3 Chalybeate Spring.	No. 4 Alum Spring.	No. 5 Alum Spring.	No. 6 Alum Spring.
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>
Sodium carbonate .....	0.99	.....	.....	.....
Calcium carbonate .....	0.83	.....	.....	.....
Magnesium carbonate .....	1.10	.....	.....	.....
Potassium carbonate .....	0.76	.....	.....	.....
Iron carbonate .....	0.11	.....	.....	.....
Sodium sulphate .....	.....	0.66	2.35	1.79
Calcium sulphate .....	3.09	14.65	16.95	19.11
Magnesium sulphate .....	.....	0.53	0.34	0.57
Potassium sulphate .....	.....	0.54	0.90	1.01
Aluminium sulphate .....	.....	16.69	17.95	38.41
Iron sulphate .....	.....	9.54	13.14	12.92
Silica .....	0.91	1.95	2.11	2.11
Sulphuric acid .....	.....	5.05	9.82	6.54
Organic matter .....	.....	3.75	.....	.....
Total .....	7.79	53.36	63.56	88.46
<i>Gas.</i>				
Carbonic acid .....	<i>Cubic inches.</i> 16.00	.....	.....	.....

\* D. K. Tuttle, analyst (1859).

<sup>b</sup> J. L. Campbell, analyst.

*Analyses of mineral springs in Virginia—Continued.*

Constituents.	Rock Enon Springs.	Roanoke Red Sulphur Springs.	Seven Springs, Abing- don.	Shenan- doah Alum Springs.	Sweet Chalybeate Springs: Red Spring.		Variety Springs: Alum Spring.
	<i>Grains per gall.<sup>a</sup></i>	<i>Grains per gall.<sup>b</sup></i>	<i>Parts in 100.<sup>c</sup></i>	<i>Grains per imp. gall.<sup>d</sup></i>	<i>Grains per gall.<sup>e</sup></i>	<i>Grains per gall.<sup>f</sup></i>	<i>Grains per gall.<sup>g</sup></i>
Sodium carbonate.....	1.21						
Calcium carbonate.....	5.13	6.53			2.70	16.00	
Magnesium carbonate.....		5.84				12.00	
Lithium carbonate.....		0.02					
Manganese carbonate.....		0.02					
Iron carbonate.....		0.06				8.00	
Copper carbonate.....		Trace					
Sodium sulphate.....		3.04	0.23		3.23		
Calcium sulphate.....	3.56	2.19	17.54		32.88		13.33
Lithium sulphate.....			0.02				
Magnesium sulphate.....	12.89		16.00		7.18	4.00	11.64
Potassium sulphate.....		0.33	0.06				0.29
Strontium sulphate.....		1.71	Trace				
Barium sulphate.....		Trace					
Aluminium sulphate.....			15.22				34.41
Ammonium sulphate.....			0.02				
Manganese sulphate.....			0.26				
Iron protosulphate.....			0.41				5.11
Iron persulphate.....			4.63				
Nickel sulphate.....			0.16				
Cobalt sulphate.....			0.01				
Copper sulphate.....			0.01				
Zinc sulphate.....			0.30				
Lead sulphate.....		Trace					
Sodium hyposulphite.....		0.03					
Ammonium nitrate.....		0.05					
Calcium phosphate.....		0.03	Trace				
Sodium chloride.....		0.24	0.33		0.09	2.00	0.29
Magnesium chloride.....	1.12				1.57		
Calcium chloride.....					0.02		
Ammonium chloride.....		0.02					
Calcium fluoride.....			Trace				
Iron (combined).....						4.00	
Iron oxide or protoxide.....	14.25			5.22			
Iron sesquioxide.....					0.73		
Manganese protoxide.....	1.05						
Arsenic.....		Trace					
Alumina.....	0.80	0.01		12.39			
Silica.....	0.42	0.84	1.50			4.00	1.13
Sulphuric acid.....				59.54			1.37
Organic matter.....		0.76	0.12				
Water.....			42.94				
Total.....	40.43	21.71	99.76	77.15	48.40	50.00	67.57
<i>Gases.</i>	<i>Cub. ins. in 100.</i>	<i>Cub. ins. per gall.</i>	<i>Cub. ins. in 100.</i>	<i>Cub. ins. in 100.</i>	<i>Cub. ins. in 100.</i>	<i>Cub. ins. in 100.</i>	<i>Cub. ins. in 100.</i>
Carbonic acid.....		12.40			46.10		
Sulphureted hydrogen.....		2.44			Trace		
Oxygen.....					0.20		
Nitrogen.....					2.57		

<sup>a</sup> Gale and Mew, analysts.

<sup>b</sup> M. B. Hardin, analyst (1875).

<sup>c</sup> J. W. Mallet, analyst (1875).

<sup>d</sup> J. W. Mallet, analyst (1873).

<sup>e</sup> W. B. Rogers, analyst.

<sup>f</sup> Rowelle, analyst.

<sup>g</sup> William Gilham, analyst (1859).

*Analysees of mineral springs in Virginia—Continued.*

Constituents.	Wallawhatoola Alum Springs.		Warm Sulphur Springs.		Wolf Trap Lithia Springs.	Yellow Sulphur Springs.	Wayland Spring
	Grains per gall. <sup>a</sup>	Grains per gall. <sup>b</sup>	Grains per gall. <sup>c</sup>	Grains per gall. <sup>d</sup>	Grains per gall. <sup>e</sup>	Grains per gall. <sup>f</sup>	Grains per gall. <sup>g</sup>
Sodium carbonate .....					0.24		
Calcium carbonate .....			4.29	5.22	7.41	8.64	
Calcium bicarbonate .....							3.04
Magnesium carbonate .....					5.09	1.38	
Magnesium bicarbonate .....							1.05
Lithium carbonate .....					0.02		
Strontium carbonate .....					0.39		
Ammonium carbonate .....					Trace		
Barium carbonate .....					Trace		
Manganese carbonate .....					0.01		
Iron carbonate .....					0.06	0.62	
Iron bicarbonate .....							0.91
Zinc carbonate .....					Trace		
Copper carbonate .....					Trace		
Calcium sulphate .....	13.27	7.538	5.47	14.53		63.30	
Aluminium sulphate .....	72.10	137.889				3.18	
Magnesium sulphate .....	2.31	15.434	9.98			21.10	
Lithium sulphate .....		0.128					
Magnesium sulphate .....		1.245					
Potassium sulphate .....	2.09			1.38	0.06	0.10	
Potassium and aluminium sulphate.		4.201					
Sodium and aluminium sulphate.		3.867					
Sodium sulphate .....	2.12				0.06	0.75	
Ammonium sulphate .....				0.36			
Iron protosulphate .....	5.39	0.489					
Iron persulphate .....		23.741					
Sodium nitrate .....					2.63		
Calcium phosphate .....		0.055				0.01	
Magnesium phosphate .....						Trace	
Aluminium phosphate .....					0.04		
Magnesium baborate .....					Trace		
Sodium silicate .....	2.04						
Magnesium silicate .....				1.72			
Iron crenate .....				2.50			
Sodium chloride .....	0.39	0.710			2.63	0.07	
Calcium chloride .....			3.97				
Potassium chloride .....						0.10	
Calcium fluoride .....					Trace		
Sodium bromide .....					0.01		
Soda .....			Trace				
Lithia .....	Trace	Trace					
Titanic oxide .....					Trace		
Iron oxide or protoxide .....		20.040				Trace	
Silica .....		4.111			2.02		
Sulphuric acid .....	33.82						
Carbonic acid .....				6.92			
Organic matter .....	1.75	Trace			Trace	3.73	
Total .....	135.28	199.408	23.71	32.63	20.67	104.98	5.00
<i>Gases.</i>	<i>Cub. ins. in 100.</i>	<i>Cub. ins. in 100.</i>	<i>Cub. ins. in 100.</i>	<i>Cub. ins. in 100.</i>	<i>Cub. ins. in 100.</i>	<i>Cub. ins. in 100.</i>	<i>Cub. ins. in 100.</i>
Carbonic acid .....	In excess			1.02			
Sulphureted hydrogen .....			0.19	0.25			
Oxygen .....					1.70		
Nitrogen .....			1.62	3.25	3.60		
Carbon dioxide .....			2.64		12.38	10.00	

<sup>a</sup> J. L. Campbell, analyst (1879).<sup>b</sup> C. F. Chandler, analyst (1884).<sup>c</sup> W. B. Rogers, analyst (1835).<sup>d</sup> A. A. Hayes, analyst (1852).<sup>e</sup> M. B. Hardin, analyst (1880).<sup>f</sup> William Gilham, analyst.<sup>g</sup> W. S. C. Taylor, analyst (1883).<sup>h</sup> With iodide.

WEST VIRGINIA.

West Virginia is noted for its mineral springs. Berkeley Springs is one of the oldest resorts in the United States, the town of Bath, named after the English watering place, having been laid out in 1777, while Greenbrier White Sulphur Springs, which are so well known throughout the country, have been used medicinally since 1778 or 1779. The best known springs are in the eastern and southeastern portions of the State, especially in the Alleghany Mountains. The western counties also have a number of important springs and mineral wells, and when the central part of the State becomes better known many springs will probably be added to the list. The general characters of the waters are like those of Virginia. The springs are thermal and cold, saline, chalybeate, carbonated, sulphureted, and acid. The saline and sulphureted waters predominate.

*Mineral springs of West Virginia.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Alum Spring, 1 mile from Little Sewell Mountain, Greenbrier County.	.....	.....	o	.....	Unimproved.
Aurora Highlands Spring, Anrora, Preston County.	1	75	48	.....	Improved.
Barger's Springs, Barger's Springs, Summers County.	2	20	.....	.....	Local resort.
Berkeley Springs, Berkeley Springs, Morgan County.	5	3,000	75	Calcic .....	Resort.
Blue Sulphur Springs, Blue Sulphur Springs, Greenbrier County.	2	2,000	46	Sulphureted ....	Resort prior to the war.
Bluish-White Sulphur Spring, Edray, Pocahontas County.	1	4	.....	do .....	Unimproved.
Borland Mineral Well, Borland*, Pleasants County.	.....	.....	.....	Alkaline, saline, sulphureted.	Local resort.
Capon Springs, Capon Springs, Hampshire County.	.....	.....	54 to 66	Alkaline, carbonated.	Used commercially and as a resort.
<i>Chalybeate springs:</i>					
Near Fayette Station, Fayette County.	.....	.....	.....	.....	Unimportant and unimproved.
Near Edray, Pocahontas County.	1	.....	.....	.....	Unimproved.
Near Brandywine, Pendleton Co.	3	.....	.....	Chalybeate .....	Do.
Columbia Sulphur Spring, Columbia Sulphur Springs, Greenbrier County.	1	10	.....	.....	Used to small extent as a resort.
Crimson Springs, Crimson Springs, Monroe County.	.....	.....	.....	.....	Unimproved; used locally for medicinal purposes.
Flooding Springs (Blue Sulphur Springs), Flooding Springs, Cabell County.	2	.....	.....	Sulphureted ....	Resort.
Greenbrier White Sulphur Springs, White Sulphur Springs, Greenbrier County.	2	1,860+	62	Calcic, sulphureted, and chalybeate.	Used commercially and as a resort.
Green Sulphur Springs, Green Sulphur Springs, Summers County.	3	.....	.....	Sulphureted, &c.	Unimproved.
Grey Sulphur Springs, Peterstown, Monroe County.	2	.....	56	Saline, sulphureted.	Unimportant now, but used as a resort prior to 1840.
Guinn's Spring, near mouth of Lick Creek, Fayette County.	.....	.....	.....	Sulphureted ....	.....
Hardy White Sulphur Springs, 14 miles south of Moorefield, Hardy County.	.....	65	48 to 50	do .....	.....

\* This locality is taken from Walton.

*Mineral springs of West Virginia—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fabr.	Character of the water.	Remarks
Hart Well, near Willow Island, Pleasants County.	.....	.....	o	Alkaline, saline.	Resort.
Howard's Lick, Howard's Lick, Hardy County.	.....	.....	.....	.....	.....
Humphrey's Spring, between Salt Sulphur and Red Sulphur Springs, Monroe County.	.....	.....	50 to 60	.....	.....
Irondale Spring, Irondale Furnace, Independence, Preston County.	1	180	45	Calcic, saline ...	Used commercially.
Kanawha Saline Spring, Kanawha Valley.	.....	.....	.....	Saline .....	.....
Magnesia Spring, near White Sulphur Springs, Greenbrier County.	.....	.....	.....	Calcic, saline ...	.....
Mechem's Spring, 2 miles from Berkeley Springs, Morgan County.	.....	.....	.....	.....	.....
Mineral Springs, near Clarksburg, Harrison County.	.....	.....	.....	.....	.....
Mineral Well, Millhouse Ridge, near Muse's Bottom, Jackson County.	1	.....	.....	.....	.....
Orrick's Sulphur Spring, 4 miles from Berkeley Springs, Morgan County.	.....	.....	58	Sulphureted ...	.....
Parkersburg Mineral Wells, 6 miles south of Parkersburg, Mineral Wells, Wood County.	10	40	46	Saline, carbonated.	Used commercially and as a resort.
Red Sulphur Springs, Red Sulphur Springs, Monroe County.	2	210	51	Sulphureted ...	Do.
Salt Sulphur Springs, Salt Sulphur Springs, Monroe County.	4	400+	49 to 65½	...do .....	Do.
Shannondale Springs, 5½ miles from Charlestown, Jefferson County.	3	.....	55	Saline, chalybeate.	Resort.
Sharpnack's Well (650 feet), Petroleum, Ritchie County.	1	500	.....	.....	Used to some extent as a resort.
Spa Spring, 1½ miles from Berkeley Springs, Morgan County.	.....	.....	53	Chalybeate .....	.....
<i>Sulphur springs:</i> Near Blue Sulphur Springs, Greenbrier County.	3	.....	.....	.....	Unimproved.
Sweet Springs, Sweet Springs, Monroe County.	1+	48,000	79	Calcic .....	Resort.
Webster Salt Sulphur Springs, Webster Court-House, Webster County.	2	.....	.....	Saline, sulphureted.	Used to some extent as a resort.

*Analyses of mineral springs in West Virginia.*

Constituents.	Berkeley Springs.	Blue Sulphur Springs.	Borland Mineral Well.	Capon Springs.	
				Main Spring.	Beauty Spring.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.</i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per imp. gallon.<sup>c</sup></i>	<i>Grains per imp. gallon.<sup>c</sup></i>
Sodium carbonate .....			77.80	0.59	0.63
Calcium carbonate .....	5.00	5.05	8.75	8.33	8.36
Magnesium carbonate .....		0.94	1.86	1.44	1.27
Lithium carbonate .....				Trace	Trace
Manganese carbonate .....				Trace	Trace
Iron carbonate .....				0.04	0.05
Aluminium carbonate .....			0.64		
Copper carbonate .....					Trace
Sodium sulphate .....		16.22	37.87		
Calcium sulphate .....		46.55		0.59	0.41
Magnesium sulphate .....	0.36	6.38			
Potassium sulphate .....			22.62	0.17	0.16
Strontium sulphate .....				Trace	Trace
Nitrates .....				Trace	Trace
Calcium phosphate .....				Trace	Trace
Aluminium phosphate .....			0.23		
Earthy phosphates .....		Trace.			
Calcium silicate .....	0.64				
Calcium crenate .....	3.64				
Iron crenate .....	0.08				
Sodium chloride .....	0.89	4.21	240.07	0.06	0.05
Calcium chloride .....	0.21	0.01			Trace
Magnesium chloride .....			2.14		
Calcium fluoride .....				Trace	Trace
Magnesium bromide .....			0.28		
Magnesium iodide .....			0.02		
Iron protoxide .....		0.03			
Manganese .....			Trace		
Alumina .....				0.02	0.02
Silica .....			0.59	0.70	0.67
Iodine .....		Trace			
Organic matter .....		6.93	Trace	0.20	0.19
Loss .....	0.06				
Total .....	10.88	86.32	392.87	12.14	11.81
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbonic acid .....	19.00	6.35		8.56	7.76
Sulphureted hydrogen .....		1.03			
Oxygen .....	16.60	1.29		1.76	1.68
Nitrogen .....	64.30	7.49		3.68	3.68
Total .....	19.90	16.16		14.00	13.12

<sup>a</sup> A. A. Hayes, analyst (1855).

<sup>b</sup> T. G. Wormley, analyst.

<sup>c</sup> J. W. Mallett, analyst.

*Analyses of mineral springs in West Virginia—Continued.*

Constituents.	Grey Sulphur Springs.			Greenbrier White Sulphur Springs.		
	Aperient Spring.	Anti-dyspeptic Spring.		Name unknown.	Name unknown.	Sour Spring.
<i>Solids.</i>	<i>Grains in 100 cu. in.<sup>a</sup></i>	<i>Grains in 100 cu. in.<sup>a</sup></i>	<i>Parts in 100.+<sup>b</sup></i>	<i>Grains per gall.<sup>c</sup></i>	<i>Grains per gall.<sup>a</sup></i>	<i>Grains in 100 cu. in.<sup>a</sup></i>
Sodium carbonate .....	1.75	2.46	50.00	.....	.....	.....
Calcium carbonate .....	2.07	2.84	38.90	7.07	3.53	.....
Magnesium carbonate .....	2.46	1.68	8.10	.....	1.17	.....
Ammonium carbonate .....	Trace	Trace	.....	.....	.....	.....
Sodium sulphate .....	0.36	0.43	.....	.....	9.35	.....
Calcium sulphate .....	.....	.....	Trace	78.35	73.19	.....
Magnesium sulphate .....	.....	.....	Trace	35.42	19.03	.....
Aluminium sulphate .....	.....	.....	.....	.....	0.02	.....
Iron protosulphate .....	.....	.....	.....	.....	0.15	.....
Earthy phosphates .....	.....	.....	.....	.....	Trace	.....
Silicates .....	.....	.....	.....	3.46	.....	.....
Sodium chloride .....	0.34	0.21	Trace	.....	0.52	.....
Calcium chloride .....	.....	.....	.....	.....	0.02	.....
Magnesium chloride .....	.....	.....	.....	1.00	0.16	.....
Potassium chloride .....	Trace	Trace	.....	.....	.....	.....
Magnesia .....	.....	.....	.....	.....	.....	Trace
Lime .....	.....	.....	.....	.....	.....	5.65
Iron oxide .....	.....	.....	Trace	.....	.....	.....
Iron protoxide .....	.....	.....	.....	.....	.....	12.12
Iron peroxide .....	0.09	0.05	.....	.....	.....	.....
Alumina .....	.....	.....	.....	.....	.....	16.20
Silica .....	0.75	0.32	3.60	.....	( <sup>d</sup> )	.....
Iodine .....	.....	.....	.....	.....	.....	.....
Sulphuric acid .....	.....	.....	.....	.....	.....	48.83
Organic matter .....	Large am't	Large am't	.....	4.36	0.01	.....
Total .....	7.82	7.99	<sup>e</sup> 100.60	129.66	107.15	82.80
<i>Gases.</i>	<i>Cub. inches.</i>	<i>Cub. inches.</i>	<i>Cub. inches.</i>	<i>Cub. inches.</i>	<i>Cub. inches.</i>	<i>Cub. inches.</i>
Carbonic acid .....	6.18	6.54	.....	11.28	8.48	.....
Sulphureted hydrogen .....	0.41	0.20	.....	0.24	2.96	.....
Oxygen .....	0.40	0.40	.....	0.48	0.40	.....
Nitrogen .....	3.00	3.07	.....	4.64	4.32	.....
Total .....	.....	.....	.....	16.64	16.16	.....

<sup>a</sup> W. B. Rogers, analyst.<sup>b</sup> C. U. Shepard, analyst (1835).<sup>c</sup> A. A. Hayes, analyst (1842).<sup>d</sup> Undetermined.<sup>e</sup> There are 22.15 grains per gallon.

Analyses of mineral springs in West Virginia—Continued.

Constituents.	Hart Well.	Howard's Lick.	Humphrey's Spring.	Irondale Spring.	Magnesia Spring, near White Sulphur Springs.	Parkersburg Mineral Wells.
<i>Solids.</i>	<i>Grains per gall.<sup>a</sup></i>	<i>Grains in 200 cu. in.<sup>b</sup></i>	<i>Grains in 100 cu. in.<sup>b</sup></i>	<i>Grains per gall.<sup>a</sup></i>	<i>Grains per imp. gall.<sup>d</sup></i>	<i>Grains per gall.<sup>c</sup></i>
Sodium carbonate .....	78.86	5.33	.....	.....	.....	4.00
Calcium carbonate .....	8.86	0.44	6.38	.....	22.37	.....
Magnesium carbonate .....	1.88	0.20	1.01	.....	11.16	.....
Iron carbonate .....	0.70	.....	.....	.....	0.32	.....
Sodium sulphate .....	38.38	0.19	15.54	.....	1.20	24.00
Calcium sulphate .....	.....	.....	8.73	60.42	21.01	.....
Magnesium sulphate .....	.....	.....	4.23	4.34	12.06	10.00
Potassium sulphate .....	22.92	.....	.....	6.76	1.46	.....
Aluminium sulphate .....	.....	.....	.....	11.34	.....	.....
Ammonium sulphate .....	.....	.....	.....	.....	0.18	.....
Manganese sulphate .....	.....	.....	.....	2.86	.....	.....
Iron sulphate .....	.....	.....	.....	Trace	.....	4.00
Aluminium phosphate .....	0.23	.....	.....	.....	.....	.....
Sodium chloride .....	243.59	0.46	2.73	1.36	1.26	41.00
Magnesium chloride .....	2.16	.....	1.61	.....	.....	.....
Potassium chloride .....	.....	.....	.....	.....	1.74	.....
Magnesium bromide .....	0.28	.....	.....	.....	.....	.....
Magnesium iodide .....	0.02	.....	.....	.....	.....	.....
Lithia .....	.....	.....	.....	.....	Trace	.....
Iron protoxide .....	.....	.....	Trace	.....	.....	.....
Iron peroxide .....	.....	0.12	.....	.....	0.43	.....
Manganese .....	0.07	.....	.....	.....	.....	.....
Silica .....	0.58	0.37	.....	1.44	0.86	.....
Iodine .....	.....	.....	Trace	Trace	Trace	1.00
Bromine .....	.....	.....	.....	.....	Trace	.....
Sulphuric acid .....	.....	.....	.....	.....	.....	.....
Organic matter .....	Trace	Trace	Much	.....	Trace	.....
Vegetable and volatile substances .....	.....	.....	.....	8.24	.....	.....
Total .....	398.53	7.11	40.23	96.76	74.05	84.00
<i>Gas.</i>	.....	.....	.....	.....	.....	.....
Carbonic acid .....	.....	.....	.....	.....	.....	16.00

Constituents.	Salt Sulphur Springs.		Shannondale Springs.	Sweet Springs.	Red Sulphur Springs.
	Old Spring.	Iodine Spring.			
<i>Solids.</i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>i</sup></i>	<i>Grains in 100 grains of solid contents.<sup>j</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>k</sup></i>
Sodium carbonate .....	.....	10.80	.....	.....	.....
Calcium carbonate .....	10.26	33.00	10.5	30.06	5.25
Magnesium carbonate .....	3.31	7.00	.....	0.82	4.81
Potassium carbonate .....	.....	2.33	.....	.....	.....
Iron carbonate .....	.....	.....	0.7	.....	.....
Sodium sulphate .....	22.36	24.00	.....	6.34	4.14
Calcium sulphate .....	84.90	68.00	63.0	13.17	0.55
Magnesium sulphate .....	18.21	20.00	23.5	9.39	.....
Iron sulphate .....	.....	.....	0.3	.....	.....
Earthy phosphates .....	Trace	0.73	.....	Trace	0.82
Sodium chloride .....	1.58	1.50	1.0	0.14	.....
Calcium chloride .....	0.06	0.56	.....	0.14	.....
Magnesium chloride .....	0.26	0.28	1.0	0.31	.....
Iron peroxide .....	0.10	1.06	.....	0.14	.....
Alumina .....	.....	0.18	.....	.....	.....
Silica .....	.....	1.76	.....	0.17	.....
Iodine .....	Trace	0.63	.....	Trace	.....
Bromine .....	.....	0.65	.....	.....	.....
Organic matter .....	9.24	.....	.....	.....	8.39
Total .....	150.28	172.48	100.0	60.68	23.96
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbonic acid .....	13.28	34.56	Undetermined	88.00	8.00
Sulphureted hydrogen .....	3.44	19.12	Undetermined	.....	1.04

<sup>a</sup> S. C. Wells, analyst.      <sup>c</sup> S. F. Berny, analyst.      <sup>i</sup> D. Stewart, analyst.  
<sup>b</sup> W. B. Rogers, analyst.      <sup>d</sup> With cobalt and nitric acid.      <sup>j</sup> DeButts, analyst.  
<sup>e</sup> Prof. Breneman, analyst.      <sup>g</sup> With sodium.      <sup>k</sup> A. A. Hayes, analyst (1842).  
<sup>f</sup> Wm. E. A. Aiken, analyst.      <sup>h</sup> With sulphur.

## NORTH CAROLINA.

North Carolina enjoys the distinction of being one of the two States on the Atlantic coast that possess hot springs. Usually her mineral springs are not different from those occurring along the coast and in the region of the Appalachians in the neighboring States. As in Virginia, chalybeate and sulphureted springs are most numerous. The books usually credit the State with four or five localities. The present list includes 66, of which a fair proportion are utilized as places of resort, while many have well-established local reputations. Seven of the springs are used commercially. Analyses are given of 18 springs.

For a considerable number of these thanks are due to Prof. Charles W. Dabney, jr., of the State agricultural experiment station. Others are taken from Professor Kerr's report on the geology of North Carolina. The greatest part of the information as to the spring localities has been derived from direct correspondence with the spring-owners.

*Mineral springs of North Carolina.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
All Healing Springs, All Healing, Gaston County.	12	3,800+	52 to 58	Chalybeate, sulphureted.	Resort.
Alum Spring, near Catharine Lake, Onslow County.	1	90,000	62	Chalybeate, sulphur.	Do.
Alum Spring, Bald Mountain, near Chimney Rock, Rutherford County.	.....	.....	.....	.....	Has local reputation.
Bell Spring, Palmerville, Stanly Co.	1	.....	.....	.....	Local resort.
Blackwell's White Sulphur Springs, 4 miles from Alexander, Buncombe County.	4	50+	.....	Sulphureted	Resort.
Burke's Chalybeate Springs, near Taylorsville, Alexander County.	.....	.....	.....	.....	Unimproved.
Chalybeate Mineral Spring, near Varina, Wake County.	1	15	.....	.....	Do.
<i>Chalybeate springs:</i>					
Near Marion, McDowell County.	.....	.....	.....	.....	.....
Five miles south of Wadesborough, Anson County.	.....	.....	.....	.....	.....
West of Sandford, Moore County.	.....	.....	.....	.....	.....
One and a half miles west of Ellerbe Springs, Richmond County.	.....	.....	60	.....	.....
Near Laurinburg, Richmond Co.	.....	.....	62	.....	.....
Near Shelby, Cleveland County.	.....	.....	.....	.....	.....
Charlotte Mineral Spring, Charlotte, Mecklenburg County.	.....	.....	.....	.....	.....
Chatham Mineral Spring, near Pittsborough, Chatham County.	.....	.....	.....	Saline	.....
Cleveland Mineral Springs, near Shelby, Cleveland County.	3	180	58	Sulphureted, chalybeate, &c.	Resort.
Cowhead Spring, 4 miles north of Washington, Beaufort County.	.....	.....	60	Chalybeate	Do.
Creswell's Sulphur Spring, 2 miles from Mooresville, Iredell County.	1	9	.....	Sulphureted	Do.
Dennison's Mineral Well, New Berne, Craven County.	1	.....	60	.....	.....
De Hart's Springs, near Nantahalalah, Swain County.	.....	.....	.....	.....	.....

*Mineral springs of North Carolina—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Ellendale Chalybeate Springs, Ellendale, west of Taylorsville, Alexander County.	.....	.....	o	.....	To be used commercially in future.
Ellerbe Spring, Ellerbe Springs, Richmond County.	1	60	60	.....	Local resort.
Enpeptic Spring, 15 miles north of Statesville, Iredell County.	1	9	.....	Sulphureted	Once a considerable resort.
Ewing Springs, Sulphur Springs, Montgomery County.	.....	.....	65	.....	.....
Glen Alpine Spring, 10 miles south of Morganton, Burke County.	.....	.....	.....	Saline, carbonated.	Resort.
Haywood White Sulphur Springs, Waynesville, Haywood County.	.....	.....	.....	.....	Local resort.
Healing Springs, Healing Springs, Davidson County.	2	120	.....	.....	Do.
Henderson Mineral Springs, 1 mile from Henderson, Vance County.	2	45	50	Chalybeate	Resort to limited extent.
Henson's White Sulphur Spring, near Island Ford, Rutherford County.	1	.....	.....	Sulphureted	Resort.
Jackson Springs, Jackson Springs, Moore County.	2	80	61	Chalybeate	Was once a resort.
Jones' White Sulphur and Chalybeate Springs, 10 miles south of Ridgeway and 11 miles from Warrenton, Warren County.	2	.....	.....	.....	Unimproved.
Kittrell Springs, Kittrell, Vance County.	.....	.....	.....	Chalybeate	.....
Lawrence's Chalybeate Spring, Murfreesborough, Hertford County.	.....	.....	.....	do	.....
Lemon Springs, Lemon Springs, 2 miles west of Munn's Station, Moore County.	2	.....	59	Chalybeate, &c.	Water is sold to some extent and the place is a small resort.
Leinster or Poison Springs, 5 miles south of Statesville, Iredell County.	7	.....	.....	.....	Used commercially and as a resort.
Lewis Spring, near Green Hill, Rutherford County.	.....	.....	.....	.....	Has local reputation.
Loudermilk Sulphur Spring, 5 miles west of Taylorsville, Alexander County.	.....	.....	.....	.....	Once a resort; unimproved at present.
Manganus Springs, 1½ miles north of Chapel Hill, Orange County.	2	.....	.....	Sulphureted and chalybeate.	.....
McBride's Springs, near Shelby, Cleveland County.	.....	.....	.....	.....	.....
Millstead's All Healing Mineral Spring, near Ellendale, Alexander County.	1	120	56	.....	Resort.
<i>Mineral springs:</i>					
At Ansonville, Anson County	.....	.....	.....	.....	.....
Ten miles southwest of Wadesborough, Anson County.	.....	.....	60	.....	.....
At Haw River, Alamance County.	.....	.....	.....	Lithia	.....
At Icard Station, Burke County	.....	.....	.....	.....	.....
Seven miles northeast of Asheville, Buncombe County.	.....	.....	.....	.....	.....
Near Rock Spring, Orange County	2	.....	.....	.....	.....
At Greensborough, Guilford Co.	.....	.....	.....	.....	.....
Mineral Well, Thomasville, Davidson County.	.....	.....	.....	.....	.....
Misenheimer's Sulphur Springs, near Copal Grove, Stanly County.	2	10+	.....	Sulphureted and chalybeate.	Do.
Misheman's Springs, near Bilesville, Stanly County.	.....	.....	.....	Chalybeate	.....
Mount Vernon Mineral Springs, Mount Vernon Springs, Chatham County.	2	.....	.....	.....	Used commercially to small extent and as a resort.
Panacea Springs, Panacea Springs, Halifax County.	13	3,700	58 to 60	Saline, carbonated, and chalybeate.	Used commercially and as a resort.
Park's Alkaline Mineral Spring, 6 miles east of Pelham, Caswell County.	1	50	56	Caloric	Used commercially and as a local resort.

*Mineral springs of North Carolina—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Patterson Springs, near Shelby, Cleveland County.	-----	-----	o	-----	-----
Piedmont Springs, near Danbury, Stokes County.	2	-----	65	Chalybeate	Resort.
Piedmont Springs, Piedmont Springs, Burke County.	2	-----	-----	Sulphureted and chalybeate.	Do.
Rocky River Springs, near Silver, Stanly County.	9	400	56	-----	Do.
Seven Springs, Seven Springs, Wayne County.	7	433	-----	Chalybeate, &c.	Used commercially and as a resort.
Shaw's Healing Springs, $\frac{1}{2}$ mile north of Littleton, Halifax County.	16	-----	-----	-----	Resort.
Shocco Springs, 5 miles from Warrenton, Warren County.	-----	-----	-----	-----	Do.
Sparkling Catawba Springs, Sparkling Catawba Springs, 6 miles from Hickory, Catawba County.	5	60	59	Saline, carbonated.	Used commercially to some extent and as a resort.
Stonewall Springs, 6 miles from Graham, Alamance County.	-----	-----	-----	-----	-----
Strader's Mineral Spring, 3 miles north of Pelham, Caswell County.	-----	-----	-----	Chalybeate	Unimproved.
Sue Spring, near Warrenton, Warren County.	-----	-----	-----	Sulphureted (?)	-----
Sulphur and Chalybeate Springs, on French Broad River, Madison County.	-----	-----	-----	-----	-----
Sulphur Springs, Sulphur Springs, Montgomery County.	2	20	40	Sulphureted	Resort.
<i>Sulphur springs:</i>					
Near Petra Mills, Caldwell Co	-----	-----	-----	-----	-----
Near Settle, Iredell County	1+	-----	48	Sulphureted and chalybeate.	Local resort.
Five and one-half miles southwest of Asheville, Buncombe County.	-----	-----	-----	-----	Resort.
Ten miles northwest of Asheville, Buncombe County.	-----	-----	-----	-----	Do.
Warm Springs, Warm Springs, Madison County.	20	-----	92 to 117	-----	Do.
Warren White Sulphur Springs, 10 miles from Ridgeway, Warren County.	-----	-----	-----	-----	-----
<i>White sulphur springs:</i>					
At Catawba, Catawba County.	-----	-----	-----	-----	-----
Six miles east of Taylorsville, Alexander County.	1	50	-----	Sulphureted	Used as a resort to some extent.
Wilson's White and Red Sulphur Springs, near Shelby, Cleveland County.	-----	-----	-----	-----	-----
Wise's Spring, Murfreesborough, Hertford County.	-----	-----	-----	Chalybeate	Unimproved.
Yadkin Mineral Springs, Palmerville, Stanly County.	-----	-----	-----	Chalybeate, sulphureted.	Do.

## Analyses of mineral springs in North Carolina.

Constituents.	Alum Spring of Onslow County.	Charlotte Mineral Spring.	Chatham Mineral Spring.	Cleveland Mineral Springs.	
				White Sulphur Spring.	Red or Iodine Spring.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per imp. gallon.<sup>b</sup></i>	<i>Grains per imp. gallon.<sup>b</sup></i>	<i>Grains per gallon.</i>	<i>Grains per gallon.</i>
Calcium carbonate .....	.....	.....	.....	4.50	3.12
Calcium sulphate .....	.....	36.00	.....	18.70	<sup>c</sup> 17.42
Magnesium sulphate .....	.....	4.53	.....	.....	.....
Sulphates .....	.....	.....	Trace	.....	.....
Nitrates .....	.....	.....	Trace	.....	.....
Sodium chloride .....	.....	3.30	<sup>d</sup> 28.80	.....	.....
Magnesium chloride .....	.....	.....	36.56	7.65	.....
Calcium chloride .....	.....	.....	39.13	4.84	.....
Magnesia .....	0.49	.....	.....	.....	.....
Lime .....	4.80	.....	.....	.....	.....
Iron .....	.....	Trace	.....	.....	.....
Iron oxide .....	} <sup>e</sup> 3.80 {	.....	Trace	.....	.....
Alumina .....		Trace	Trace	.....	.....
Silica .....		<sup>f</sup> 18.97	Trace	.....	.....
Chlorine .....	1.65	.....	.....	.....	.....
Sulphuric acid .....	0.92	.....	.....	.....	.....
Organic matter .....	0.25	.....	.....	.....	.....
Total .....	5.16	.....	.....	.....	.....
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbonic acid .....	.....	.....	.....	} 4.80	} 4.22
Sulphureted hydrogen .....	.....	.....	.....		

  

Constituents.	Cowhead Spring.	Ellerbe Spring.	Glen Alpine Spring.	Greens- borough Spring.	Spring at Icard Station.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per imp. gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per imp. gallon.<sup>b</sup></i>
Calcium carbonate .....	.....	3.64	.....	.....	.....
Iron carbonate .....	.....	.....	.....	.....	2.50
Calcium sulphate .....	.....	4.56	.....	.....	.....
Sodium chloride .....	.....	0.80	.....	.....	.....
Soda .....	.....	.....	.....	0.27	.....
Magnesia .....	0.06	.....	0.25	0.42	.....
Lime .....	1.17	.....	1.72	1.62	.....
Iron oxide .....	} <sup>e</sup> 0.86 {	.....	} <sup>e</sup> 0.92 {	0.60	.....
Alumina .....		.....		0.18	.....
Silica .....		3.76		2.10	.....
Chlorine .....	0.18	.....	0.37	0.42	.....
Sulphuric acid .....	1.23	.....	0.74	0.12	.....
Carbonic acid .....	.....	.....	32.22	Large am't	.....
Organic matter .....	5.79	.....	1.79		.....
Total .....	13.05	9.00	39.61	6.75	2.50
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbonic acid .....	.....	Present	.....	.....	Large am't
Sulphureted hydrogen .....	.....	.....	.....	.....	Trace

<sup>a</sup> W. C. Kerr's Geology of North Carolina, Vol. 1 (1875).<sup>b</sup> C. W. Dabney, jr., analyst.<sup>c</sup> With iodine and magnesia.<sup>d</sup> With potassium chloride.<sup>e</sup> With alumina.<sup>f</sup> With combined water, &c.<sup>g</sup> C. W. Dabney, jr., analyst (1883).

*Analyses of mineral springs in North Carolina—Continued.*

Constituents.	Dennison's Mineral Well.	Kittrell Springs.	Panacea Spring, near Littleton.	Park's Alkaline Mineral Spring.	Mineral Well, Thomasville.
	<i>Grains per imp. gallon.<sup>a</sup></i>	<i>Grains per imp. gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>b</sup></i>
Calcium carbonate .....	12.53			4.80	
Iron carbonate .....		9.20			
Sodium sulphate .....				1.48	
Magnesium sulphate .....				1.50	
Sodium chloride .....	4.94			Trace	
Soda .....			2.23		1.09
Magnesia .....			0.20		
Magnesium .....					0.75
Potassium .....			0.70		
Lime .....			1.20		1.74
Iron .....	4.40				
Manganese .....			0.01		
Iron oxide .....			2.18	3.50	} 0.14
Alumina .....	} <sup>a</sup> 3.48 }		0.32	3.50	
Silica .....			1.18	Trace	1.01
Sulphur .....				0.15	
Chlorine .....					2.62
Phosphoric acid .....			0.53		1.00
Hydrochloric acid .....			0.81		
Sulphuric acid .....			0.43		0.40
Carbonic acid .....					0.82
Organic matter .....					3.95
Total .....	25.40	9.20	9.79	14.93	13.52
<i>Gas.</i>					
Carbonic acid .....	<i>Cubic inches.</i>	<i>Cubic inches.</i> Large amt	<i>Cubic inches.</i> Large amt	<i>Cubic inches.</i>	<i>Cubic inches.</i>

Constituents.	Warm Springs.				
	Bathing Springs.	Drinking Springs.	Warm Spring.	Iron Spring.	Hot and Warm Springs.
	<i>Grains per gallon.<sup>e</sup></i>	<i>Grains per gallon.<sup>e</sup></i>	<i>Grains per gallon.</i>	<i>Parts in 1,000,000.</i>	<i>Grains per gallon.<sup>f</sup></i>
Sodium carbonate .....			3.68		
Sodium sulphate .....	9.03	8.90	4.24		
Calcium sulphate .....	40.88	40.54			17.56
Magnesium sulphate .....	1.34	8.13	7.64		7.50
Potassium sulphate .....	0.36	0.47			
Soluble silicates .....	8.97	9.54			
Iron crenate .....			2.34		
Sodium chloride .....	0.91	1.10	2.46		
Magnesium chloride .....	0.22	0.37			} 5.00
Calcium chloride .....	10.10	8.94	11.48		
Potassium chloride .....	0.31	0.50			
Magnesium .....				7.4	
Calcium .....				140.8	
Iron .....				31.9	
Manganese .....				Trace	
Silica .....			3.82	72.1	
Sulphuric acid .....				32.4	
Carbonic acid .....				304.6	
Organic matter .....				38.2	
Insoluble residue .....					2.56
Loss .....					1.25
Total .....	72.12	78.49	35.66	627.4	33.87
<i>Gases.</i>					
Carbonic acid .....	<i>Cubic inches.</i> 10.96	<i>Cubic inches.</i> 10.72	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Sulphureted hydrogen .....	1.76	2.48			

<sup>a</sup> C. W. Dabney, jr., analyst.<sup>b</sup> W. C. Kerr, *Geology of North Carolina* (1875).<sup>c</sup> A. R. Ledoux, analyst.<sup>d</sup> With magnesia and combined oxygen.<sup>e</sup> E. Adelmarrh, analyst.<sup>f</sup> E. D. Smith, analyst.

## SOUTH CAROLINA.

Chalybeate springs are said to abound in South Carolina and many of them are resorted to locally to a considerable extent. Glenn Springs and the Charleston Artesian Well are well known beyond the State limits. The latter, with several other artesian wells in the same city, is thermal, the temperature of the waters being almost high enough to class them as hot. They are said to possess medicinal properties. So far as learned, only the Glenn Springs, Garrett Spring, and Chick's Springs are at present of commercial importance. The Williamston Springs were once a favorite resort.

*Mineral springs of South Carolina.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Ambler's Mineral Spring (formerly Griffin's), 7 miles from Pickens Court-House, Pickens County.	1	60	$\begin{matrix} 0 \\ 40 \\ 10 \\ 50 \end{matrix}$	.....	{Used on a small scale as a resort.
<i>Artesian wells:</i>					
Citadel Green, Charleston, Charleston County.	1	15,000	99.5	Alkaline, saline.	
Commercial Cotton Press, Charleston, Charleston County.	1	.....	.....	.....	
Chisolm's Mill, Charleston, Charleston County.	1	.....	.....	.....	
Coosaw, Beaufort County	.....	.....	.....	.....	
Charleston Old Artesian Well, Charleston, Charleston County.	.....	.....	87	Alkaline, saline.	
Chalybeate and sulphur springs, near the Saluda River, Laurens County.	.....	.....	.....	.....	
Cherokee Springs, 8 miles north of Spartanburg, Spartanburg County.	.....	.....	62	Chalybeate, &c.	Resort.
Chick's Springs, Chick's Springs, Greenville County.	5	200	60	Sulphureted, &c.	Resort prior to 1861; used commercially now.
Garrett Spring, $\frac{1}{2}$ mile from Spartanburg, Spartanburg County.	1	25	64	Chalybeate	Has a local reputation as a resort and is used commercially to some extent.
Glenn Springs, Glenn Springs, Spartanburg County.	2	60	60	Calcic, sulphureted.	Used commercially and as a resort.
Kirby Springs, 3 miles from Glenn Springs, Spartanburg County.	.....	.....	.....	.....	Has a local reputation.
Limestone springs, near Gaffney City, 2 miles east of Spartanburg, Spartanburg County.	.....	.....	61	Alkaline, carbonated.	Once used as a resort, now site of a school.
Love's Springs, 3 miles from Cowpens, Spartanburg County.	.....	.....	.....	.....	
<i>Mineral springs:</i>					
One-fourth mile from Taylor's Station, near Chick's Springs, Greenville County.	.....	.....	.....	Chalybeate	Unimproved.
Three and one-half miles from Taylor's Station, near Chick's Springs, Greenville County.	.....	.....	.....	Sulphureted	Do.
At Cowpens Furnace, near Pacolet, Spartanburg County.	.....	.....	.....	.....	
At Mineral Springs, Marion Co.	.....	.....	.....	Chalybeate	Resort.
At Bennettsville, Marlborough Co.	.....	.....	.....	.....	Do.
At base of Henry's Knob, York Co.	.....	.....	.....	.....	
Seven miles from Abbeville Court House, Abbeville County.	.....	.....	.....	.....	
Near Parson's Mountain, Abbeville Court House, Abbeville Co.	.....	.....	.....	Chalybeate	Unimproved.
On Saluda River, near Pinson's Ford, Abbeville County.	.....	.....	.....	Saline, chalybeate.	Do.

*Mineral springs of South Carolina—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Mineral Well, 2 miles west of Gaffney City, Spartanburg County.	.....	.....	60	.....	Unimproved.
New Spring, 8 miles north of Spartanburg, Spartanburg County.	.....	.....	64	Sulphureted, chalybeate, &c.	Has a local reputation.
Poinsett's Spring, Spartanburg County.	.....	.....	.....	.....	.....
Reedy Springs, near Cranesville, Marion County.	3	600+	.....	.....	Resort.
Seneca Mineral Springs, Seneca, Oconee County.	2	.....	.....	Chalybeate	.....
West's Spring, West Springs, Union Co.	.....	.....	65	.....do	Do.
Williamston Springs, Williamston, Anderson County.	.....	.....	.....	.....	.....
Wilson's Springs, Spartanburg County.	.....	.....	.....	.....	.....

*Analyses of mineral springs in South Carolina.*

Constituents.	Charleston Artesian Wells.				Coosaw Artesian Well.	Glenn Springs.
	Old Artesian Well.	Citadel Green Well.	Commercial Cotton Press Well.	Chisolm's Mill Well.		
	Grains per gallon. <sup>a</sup>	Grains per gallon. <sup>b</sup>	Grains per gallon. <sup>c</sup>	Grains per gallon. <sup>c</sup>	Grains per gallon. <sup>d</sup>	Grains per gallon. <sup>e</sup>
Sodium carbonate	.....	47.26	.....	30.88	30.75	.....
Sodium bicarbonate	71.06	.....	.....	.....	.....	.....
Calcium carbonate	.....	.....	26.24	.....	.....	.....
Calcium bicarbonate	0.12	.....	.....	.....	.....	.....
Magnesium carbonate	.....	.....	.....	.....	.....	3.32
Magnesium bicarbonate	0.02	.....	.....	.....	.....	.....
Iron carbonate	.....	0.34	.....	.....	.....	.....
Sodium sulphate	.....	.....	.....	.....	2.24	.....
Calcium sulphate	.....	0.44	10.62	4.12	0.63	91.50
Potassium sulphate	.....	.....	.....	19.21	.....	.....
Magnesium sulphate	.....	0.17	13.88	2.82	1.04	.....
Potassium nitrate	.....	.....	.....	.....	0.80	.....
Sodium nitrate	.....	0.55	.....	.....	.....	.....
Sodium chloride	63.38	11.39	.....	136.88	6.29	2.21
Potassium chloride	.....	0.23	.....	4.85	1.94	0.52
Sodium silicate	.....	2.52	204.41	0.66	1.82	.....
Alkalies, chlorides	.....	.....	1.98	.....	.....	.....
Silica	Trace	0.36	.....	2.34	1.20	.....
Loss	.....	.....	.....	13.17	.....	.....
Organic matter	Trace	1.73	.....	.....	1.47	.....
Iron oxide	Trace	.....	.....	.....	.....	.....
Carbonic acid	0.79	.....	.....	.....	.....	.....
Aluminium oxide	Trace	.....	.....	.....	.....	.....
Undetermined	.....	.....	7.35	.....	.....	.....
Total	135.37	64.99	264.48	214.93	48.18	97.55

<sup>a</sup>C. U. Shepherd, jr., analyst (1868).<sup>b</sup>S. T. Robinson, analyst (1879).<sup>c</sup>William Robertson, analyst (1880).<sup>d</sup>F. F. Chisolm, analyst (1879).<sup>e</sup>C. U. Shepherd, jr., analyst (1880).

*Analyses of mineral springs in Florida.*

Constituents.	Linwood Springs.	White Sulphur Spring.	Wesson's Iron Spring.	Benson's Salt Spring.
	<i>Grains per gallon.<sup>a</sup></i>	<i>Parts in 1,000,000.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>
Sodium carbonate .....		20.91		3.61
Sodium bicarbonate .....				
Calcium carbonate .....		80.50	0.28	9.88
Calcium bicarbonate .....				
Iron carbonate .....			1.98	
Iron bicarbonate .....	9.60			
Sodium sulphate .....	52.80		2.45	5.83
Magnesium sulphate .....	67.20	25.53	2.63	26.84
Potassium sulphate .....				2.44
Magnesium bicarbonate .....				8.90
Sodium chloride .....	113.60	11.23	0.18	238.24
Potassium chloride .....		11.32	0.12	
Magnesium chloride .....	24.80			11.90
Calcium chloride .....	42.40			40.58
Phosphoric acid .....		Trace		Trace
Sodium iodide .....	Trace			
Lithium and ammonia .....			Trace	
Organic matter .....	14.40	21.32	} 1.54 {	
Loss .....				
Silica .....	Trace			1.58
Silica, soluble .....		14.40	1.27	
Sulphureted hydrogen .....		Present		Not estimated
Iron oxide .....		1.40		
Alumina oxide .....				0.43
Total .....	324.80	186.61	10.45	350.23

<sup>a</sup> A. Connell, analyst (1876).<sup>b</sup> N. A. Pratt, analyst.<sup>c</sup> A. Merrill, analyst.<sup>d</sup> Charles M. Stillwell, analyst (1880).

## SOUTHERN CENTRAL STATES.

In the Southern Central States sulphureted and chalybeate springs hold about the same proportion to the whole number of springs as in the South Atlantic States. The number of saline springs, however, is increased and the thermal springs naturally are fewer in number. A large part of the area of this division is occupied by comparatively recent formations; yet, in the northeastern part and in the western, carboniferous rocks, with the underlying sedimentaries, are well developed, and these rocks are almost always prolific in mineral springs. The Hot Springs of Arkansas are the most prominent of the thermal springs. It must be stated here that the returns from the various States, in answer to the questions sent out, are very unequal both as to the extent and the exactness of the information conveyed. In some States (as Kentucky, Tennessee, Alabama, and Arkansas) the geological surveys of the State appear to have paid considerable attention to the subject, and the general public attention has therefore been turned more to the subject and data are more readily obtained.

In Mississippi and especially in Louisiana it has been more difficult to get definite information. No geological surveys of these States have been made very recently. Both States, however, have many springs of excellent mineral water.

Texas is being so rapidly developed as to its resources and so many

portions of the State are being newly settled that our list for that State will doubtless be considerably increased in the near future.

In regard to the springs utilized as places of resort and for commercial purposes, the Southern Central States compare favorably with the Southern Atlantic States.

*Summary for the Southern Central States.*

States.	Number of spring localities.	Number of individual springs.	Number of springs analyzed.	Number of springs utilized as resorts.	Number of springs used commercially.	Total number of analyses.
Alabama .....	82	220	18	22	6	19
Mississippi .....	82	110	4	13	4	4
Tennessee .....	177	311	24	62	8	25
Kentucky .....	142	296	73	21	6	80
Arkansas .....	108	459	5	24	4	5
Indian Territory..	10	15	0	1	0	0
Louisiana.....	15	28	0	6	0	0
Texas .....	105	472	13	25	8	13
Total .....	721	1,911	137	174	36	146

ALABAMA.

Although but few of the Alabama mineral waters are used commercially, there are many springs that are important as places of resort, and several are quite well known throughout the country at large. Bladen Springs, Bailey Springs, and Blount Springs are the ones generally noted in the books. The following list is made up partly from data contained in the geological reports of M. Tuomey and of Eugene A. Smith, but a great many localities have been added as the result of correspondence with persons in all parts of the State. Chalybeate and sulphureted springs are most numerous and are not confined to any portion of the State nor to one geological formation. Two of the best known sulphur springs — Bladon and Tallahatta — rise in the Tertiary, while Blount Springs, equally well known, and also sulphureted, are in the Coal Measures. Sulphur springs also abound in the northern counties, whose rocks belong to the Subcarboniferous limestones. Artesian wells are said to be numerous in the region underlaid by the rotten limestone of the Cretaceous. Such wells are usually highly charged with salts of iron, lime, magnesia, and soda. Comparatively few of the Alabama springs have been analyzed. The analyses presented here have been taken from various sources. Thanks are due to Prof. W. C. Stubbs, State chemist, who has furnished many of them.

*Mineral springs of Alabama.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Bailey Springs, Bailey Springs, Lauderdale County.	7	6	55 to 60	Chalybeate ....	Used commercially and as a resort.
Bladen Springs, Bladen Springs, Choctaw County.	5	1,250	67	Carbonated, alkaline, and sulphureted.	Do.
Blount Spring, near Bigbee, Washington County.	1	.....	.....	Sulphureted ....	Unimproved.
Blount Mineral Springs, Blount Springs, Blount County.	5	900	60	Saline, sulphureted.	Resort.
Blue Grass Sulphur Springs, Cornelia, Saint Clair County.	30+	.....	.....	Sulphureted and chalybeate.	Do.
Borden Springs, Borden Springs, Cleburne County.	.....	.....	.....	.....	Unimproved.
Bowie Springs, near Talladega, Talladega County.	.....	.....	.....	Chalybeate ....	Do.
Burning Spring, Washington County.	.....	.....	.....	.....	.....
Butler Springs, Butler Springs, Butler County.	7	206	60 to 65	.....	Used as a resort.
Carmon's Spring, near Fayette Court-House, Fayette County.	.....	.....	.....	.....	Unimproved.
<i>Chalybeate springs:</i>					
Near Akron Junction, Hale Co ...	.....	.....	.....	Chalybeate ....	Do.
Near Claiborne, Monroe County..	.....	.....	.....	do .....	Do.
Six miles southwest of Green Springs, Hale County.	.....	.....	.....	do .....	Do.
Near Gum Spring, Blount County.	.....	.....	.....	do .....	Do.
Six miles north of Jacksonville, Calhoun County.	.....	.....	.....	Chalybeate and sulphureted.	Do.
Near Jasper, Walker County....	6	.....	.....	.....	Do.
On Sand Mountain, Jackson County.	.....	.....	.....	.....	Do.
Chandler's Springs, Chandler Springs, Talladega County.	.....	.....	.....	Chalybeate ....	Used as a resort.
Cliff Springs, 8 miles northwest of Ashville, Saint Clair County.	.....	.....	.....	do .....	.....
Coffee Spring, Coffee Springs, Geneva County.	1	300	.....	Chalybeate and sulphureted.	Do.
Cook's Springs, 20 miles southwest of Ashville, or 5 miles from Wolf Creek, Saint Clair County.	.....	.....	.....	Sulphureted and chalybeate.	.....
Cullum's Springs, near Bladen Springs, Choctaw County.	3	600	60	Saline, chalybeate, and sulphureted.	Used commercially and as a resort.
Davis Springs, near Elkinont, Limestone County.	2	20	.....	.....	Unimproved.
Dr. Davis's Spring, Walker County..	.....	.....	.....	Chalybeate ....	Do.
Ellis's Spring, near Pride's Station, Colbert County.	.....	.....	.....	do .....	Used locally.
Franklin Springs, near Russellville, Franklin County.	.....	.....	.....	Saline, chalybeate.	.....
Golden Springs, near Oxford, Calhoun County.	7	.....	.....	Saline .....	Unimproved.
Greene Springs, Green Springs, Hale County.	3	.....	63 to 64	Chalybeate ....	Once used as a resort.
Harrell or Chalybeate Springs, near Blount Springs, Blount County.	.....	.....	58	do .....	Partially improved.
Healing Springs, Healing Springs, Washington County.	9	3,100	62 to 65	.....	Used commercially and as a resort.
Howell's Spring, 30 miles south of Waterloo, Lauderdale County.	.....	.....	.....	Sulphureted ....	.....
Jackson Springs, Jackson, Clarke County.	.....	.....	.....	do .....	Used locally.
Jenkins's Springs, near Mountain Meadow, Clay County.	8	.....	.....	Chalybeate ....	.....
Johnson's Wells, near Meridianville, Madison County.	.....	.....	.....	.....	Do.
Lansford Spring, near Florence, Lauderdale County.	.....	.....	.....	Saline.....	.....

*Mineral springs of Alabama—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Lay's Springs, 6 miles east of Greenwood, Etowah County.	4	.....	.....	Chalybeate and sulphureted.	Has a local reputation as resort.
Lee's Spring, near Florence, Lauderdale County.	.....	.....	.....	.....	.....
Ligon's Springs, Colbert Co., 5 miles from Russellville.	.....	.....	.....	.....	.....
Livingston Artesian Well, Livingston, Sumter County.	1	50.	68	Saline .....	Resort.
Major Shever Sulphur Springs, near Jasper, Walker County.	.....	.....	.....	Sulphureted ....	Once had a local reputation.
McCorkle's Spring, 12 miles north of Waterloo, Lauderdale County.	.....	.....	.....	Chalybeate .....	.....
Milhour (or Wooley's) Springs, Woolley Springs, Limestone County.	3	75+	47 to 52	Sulphureted ....	Is a resort.
<i>Mineral springs:</i>					
Near Hatchers, Clay County .....	.....	.....	.....	.....do .....	Unimproved.?
Near Hazel Green, Madison Co. ....	.....	.....	.....	.....do .....	Do.?
Six miles south of State line, Limestone County.	.....	.....	.....	.....do .....	Do.?
Near La Fayette, Chambers Co. ....	.....	.....	.....	.....	Do.
Near Saint Stephens, Washington County.	.....	.....	.....	.....	Do.
Near Village Springs, Blount County.	5	.....	.....	.....	Do.
At Broken Arrow, Saint Clair Co. ....	.....	.....	.....	.....	.....
Near Pisgah, Jackson County .....	.....	.....	.....	.....	Do.?
One mile from Coosada Station, Elmore County.	.....	.....	.....	.....	Do.
Moore's Springs, Maple Creek, near Athens, Limestone County.	.....	.....	.....	Sulphureted ....	.....
Newsom's Springs, 9 miles south of Barton, Colbert County.	7	.....	.....	.....	Once a resort.
Pettusville Springs, Pettusville, Limestone County.	.....	.....	.....	.....	Unimproved.
Roper Mineral Wells, Greenville, Butler County.	2	5	.....	.....	Used commercially.
Shelby Springs, near Knight, Shelby County.	7	.....	.....	.....	Resort.
Shocco Springs, near Talladega, Talladega County.	.....	.....	.....	Chalybeate and sulphureted.	.....
Speakes Springs, near Bulger's Mill, Tallapoosa County.	.....	.....	.....	.....	Once a resort, but now unimproved.
Stephenson's Springs, near Camp Spring, Lawrence County.	.....	.....	.....	.....	A resort prior to the war.
Stewart's Springs, near Florence, Lauderdale County.	4	80	.....	Saline .....	Has local reputation.
Sullivan's Mineral Springs, near Bigbee, Washington County.	10	.....	.....	Chalybeate ....	Local resort.
<i>Sulphur springs:</i>					
One mile from Frankfort, Franklin County.	.....	.....	.....	.....	Unimproved.
Near Bruner, Calhoun County .....	.....	.....	.....	.....	Do.
Eleven miles from Ashville, St. Clair County.	.....	.....	.....	.....	Resort.
Four miles from Springville, St. Clair County.	.....	.....	.....	.....	.....
Seven miles east of Stevenson, Jackson County.	.....	.....	.....	.....	.....
On Sulphur Creek, near Athens, Limestone County.	.....	.....	.....	.....	.....
Sulphur Springs, Sulphur Springs, De Kalb County.	.....	.....	.....	.....	Local resort.
Talladega Sulphur Spring, near Fayetteville, Talladega County.	1	.....	.....	Sulphureted ....	Resort.
Tallahatta Springs, Tallahatta Springs, Clarke County.	2	24	.....	.....	Do.
Tar Spring, 9 miles south of Oakville, Lawrence County.	.....	.....	.....	.....	Unimproved?
Tar Springs, 8 miles south of Dickson, Colbert County.	.....	.....	.....	.....	Local resort.

*Mineral springs of Alabama—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Taylor's Springs, 1 mile from Florence, near Centre Star, Lauderdale County.	4	80	°	Alkaline.....	
Tecumseh Sulphur and Chalybeate Springs, Tecumseh, Cherokee County.	.....	.....	.....	.....	Unimproved.
Todd Spring, near Bailey Springs, Lauderdale County.	.....	.....	.....	.....	Do.
Valhermosa Springs, Valhermosa Springs, Morgan County.	.....	.....	.....	.....	Resort.
Waterloo Mineral Spring, 1 mile from Waterloo, Lauderdale County.	.....	.....	.....	Chalybeate?...	Used locally.
West's Mineral Spring, Walker County.	.....	.....	.....	...do .....	Unimproved?
White Sulphur Springs, near Elkmont, Limestone County.	.....	.....	.....	.....	Do.
White Sulphur Springs, 6 miles east of Jacksonville, Calhoun County.	21	.....	.....	Chalybeate and sulphureted.	Used commercially and as a local resort.
Witherspoon Spring, near Florence, Lauderdale County.	.....	.....	.....	.....	
Wyndham Springs, near Oregonia, Tuscaloosa County.	.....	.....	.....	Chalybeate and sulphureted.	Once a resort.

*Analyses of mineral springs in Alabama.*

Constituents.	Bladon Springs.			
	Vichy Spring.	Branch Spring.	Sulphur Spring.	Old Spring.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>
Sodium carbonate .....	46.33	41.21	34.93	32.89
Magnesium carbonate .....	0.29	0.61	0.65	1.36
Calcium carbonate .....	0.87	2.14	2.42	2.75
Iron carbonate .....	0.49	0.23	0.76	0.02
Calcium sulphate .....	2.25	2.79	2.96	.....
Iron sulphate .....	.....	.....	.....	0.24
Sodium chloride .....	.....	.....	.....	7.69
Strontia .....	.....	.....	.....	0.32
Silica .....	.....	.....	.....	2.10
Organic matter .....	2.26	1.90	1.25	.....
Crenic acid .....	.....	.....	.....	0.73
Hypocrenic acid .....	.....	.....	.....	0.60
Total .....	52.49	48.88	42.97	48.70
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbonic acid .....	65.44	59.20	52.88	32.56
Sulphureted hydrogen .....	.....	.....	0.56	.....
Chlorine .....	1.84	1.84	1.84	.....
Total .....	67.28	61.04	55.28	32.56

Constituents.	Cullum's Springs.			Livingston Artesian Well.
	Alabama Vichy Spring.	Sulphur Spring.	Ferruginous Spring.	
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.</i>
Sodium carbonate .....	.....	57.28	0.355	.....
Sodium bicarbonate .....	65.40	11.28	.....	.....
Potassium bicarbonate .....	.....	1.64	.....	2.320
Magnesium bicarbonate .....	6.49	1.60	.....	7.140
Calcium bicarbonate .....	.....	.....	9.640	0.204
Iron bicarbonate .....	0.37	1.93	.....	.....
Sodium sulphate .....	2.46	0.52	.....	.....
Magnesium sulphate .....	.....	.....	.....	0.190
Iron perchloride .....	.....	.....	.....	0.325
Potassium chloride .....	4.54	6.53	1.170	295.435
Sodium chloride .....	.....	.....	0.520	1.839
Magnesium chloride .....	.....	.....	.....	2.983
Calcium chloride .....	.....	.....	.....	.....
Sodium iodide .....	Trace	Trace	.....	.....
Sodium bromide .....	.....	.....	.....	0.980
Silica .....	1.40	1.22	.....	.....
Sodium silicate .....	1.57	.....	.....	.....
Aluminium silicate .....	(f)	.....	3.320	.....
Silicates .....	.....	.....	.....	1.138
Strontia .....	.....	.....	.....	Trace
Bitumen .....	.....	.....	.....	.....
Organic matter .....	2.60	3.62	0.818	.....
Glairine .....	.....	.....	.....	.....
Total .....	84.83	85.62	15.823	312.554
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbonic acid .....	Trace	.....	.....	21.47
Sulphureted hydrogen .....	.....	97.10	.....	.....
Carbonic acid in combination .....	.....	.....	.....	9.32
Total .....	.....	97.10	.....	30.79

<sup>a</sup> J. L. and W. P. Riddell, analysts.<sup>b</sup> R. T. Brumby, analyst.<sup>c</sup> Abequin, analyst (1853).

*Analyses of mineral springs in Alabama—Continued.*

Constituents.	Blount Mineral Springs.			
	No. 1. Red Spring.		Sweet Spring.	Spring No. 4.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Magnesium carbonate .....	4.40	3.67	3.60	9.40
Calcium carbonate .....	6.80	7.23	4.48	5.72
Barium carbonate .....	.....	.....	.....	0.91
Iron carbonate .....	1.92	.....	1.12	3.19
Sodium sulphate .....	.....	0.89	.....	.....
Magnesium sulphate .....	1.60	.....	2.40	.....
Calcium sulphate .....	.....	0.28	.....	1.27
Calcium phosphate .....	.....	.....	.....	Trace
Potassium chloride .....	.....	.....	.....	7.07
Sodium chloride .....	32.32	29.86	30.88	23.21
Magnesium chloride .....	6.00	0.78	.....	2.04
Iodides .....	.....	Trace	.....	.....
Magnesium iodide .....	.....	.....	.....	0.14
Magnesium bromide .....	.....	.....	.....	0.16
Lithium .....	.....	.....	.....	Trace
Alumina .....	.....	43.00	.....	Trace
Silica .....	.....	2.07	.....	2.44
Sulphur .....	.....	.....	.....	.....
Total .....	53.04	47.78	42.48	55.55
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbonic acid .....	6.00	.....	6.00	4.72
Sulphureted hydrogen .....	14.96	.....	12.56	30.67
Oxygen .....	.....	.....	.....	7.08
Nitrogen .....	.....	.....	.....	.....

Constituents.	Talladega Spring.	Roper Mineral Wells.	Johnson's Wells.	Harrell Springs.
<i>Solids.</i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Parts in 1,000.<sup>e</sup></i>
Sodium carbonate .....	12.32	.....	.....	.....
Potassium carbonate .....	7.99	.....	.....	.....
Magnesium carbonate .....	0.93	.....	.....	.....
Calcium carbonate .....	8.78	.....	.....	.....
Iron carbonate .....	Trace	.....	.....	6.00
Magnesium sulphate .....	.....	.....	.....	1.00
Calcium sulphate .....	10.89	.....	.....	3.00
Magnesium phosphate .....	.....	.....	.....	0.50
Sodium chloride .....	5.34	.....	.....	.....
Soda .....	.....	1.55	27.76	.....
Potash .....	.....	8.55	1.55	.....
Magnesia .....	.....	17.61	0.22	.....
Lime .....	.....	40.47	18.91	.....
Lithium .....	.....	.....	.....	Trace
Aluminic oxide .....	.....	.....	12.41	.....
Alumina .....	1.45	.....	.....	.....
Silica .....	2.45	10.32	1.16	.....
Ferrous oxide .....	.....	66.72	.....	.....
Ferric oxide .....	.....	116.58	Trace	.....
Chlorine .....	.....	2.39	44.24	.....
Organic matter .....	.....	.....	1.98	Trace
Carbonic anhydride .....	.....	21.58	10.50	.....
Sulphuric oxide .....	.....	315.85	39.45	.....
Total .....	50.15	601.62	158.18	10.50
<i>Gas.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Sulphureted hydrogen .....	82.00	.....	.....	.....

<sup>a</sup> R. Brumby, analyst.

<sup>b</sup> Henry Leffmann, analyst.

<sup>c</sup> W. C. Stubbs, analyst.

<sup>d</sup> With phosphates.

<sup>e</sup> Summers, analyst.

*Analyses of mineral springs in Alabama—Continued.*

Constituents.	Taylor's Springs.		
	Spring No. 1.	Spring No. 2.	Spring No. 3.
	<i>Grains per gallon.*</i>	<i>Grains per gallon.*</i>	<i>Grains per gallon.*</i>
Sodium bicarbonate.....	0.42	0.49	0.43
Magnesium bicarbonate.....	0.58	0.64	0.55
Calcium bicarbonate.....	1.03	1.30	1.09
Iron bicarbonate.....	0.26	0.23	0.25
Sodium sulphate.....	0.03	0.03	0.03
Magnesium sulphate.....	0.02	0.03	0.03
Potassium chloride.....	Trace	Trace	Trace
Sodium chloride.....	0.12	0.06	0.07
Magnesium chloride.....	0.12	0.06	0.11
Calcium chloride.....	0.14	0.07	0.07
Alumina.....	Trace	Trace	Trace
Silica.....	0.29	0.32	0.26
Organic matter.....	0.81	1.01	1.54
Loss.....		0.04	
Total.....	3.82	4.30	4.43

\* J. Lawrence Smith, analyst.

## MISSISSIPPI.

The mineral springs of Mississippi are numerous, and, like those of the neighboring States, are largely chalybeate. In certain localities the greater portion of the wells and springs are highly mineralized. Waile's report on the geology of Mississippi states that, along the whole extent of the Yazoo and Tallahatchee Valleys and the whole front below, on the Mississippi River, copious springs issue from the bluffs, the water flowing from beds of ocherous earth and pyritous clays. The water is highly charged with sulphate of iron and its habitual use is very pernicious. Many of the artesian wells of the State are also mineralized. Prof. E. W. Hilgard, in his geological report for 1860, says: "Few neighborhoods in the State are without a mineral spring or well of some kind, good, bad, or indifferent." Many of these springs have extensive local reputations and appear to be used somewhat indiscriminately by the residents for medicinal purposes. Only a few of the springs have any commercial importance. Ocean Springs and Iuka Springs are the best known resorts. Cooper's Well was well known before the war and, with others, is being revived as a pleasure resort.

*Mineral springs of Mississippi.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Alkaline spring:</i> One mile east of Yazoo City, Yazoo County.	.....	.....	° 62	Alkaline.....	
<i>Alum springs:</i> In La Fayette County .....	.....	.....	.....	.....	
In Madison County .....	.....	.....	.....	.....	
In Marion County .....	.....	.....	.....	.....	
In Pike County .....	.....	.....	.....	.....	
Anchosa Spring, Anchosa Creek, near Quitman, Clarke County.	.....	.....	.....	.....	
Artesian Springs, 6 miles from Pickens, near Camden, Madison County.	4	.....	.....	Chalybeate .....	Resort.
Artesian Well (public), 512 feet, Aberdeen, Monroe County.	1	600	.....	.....do .....	
Belmont Springs, 3½ miles northeast of Buckatunna, Wayne County.	2+	3,600	.....	.....	Do.
Black Wells, Choctaw County .....	.....	.....	.....	Saline, chalybeate.	
Brandywine Spring, 20 miles east of Port Gibson, Claiborne County.	.....	.....	.....	Sulphureted .....	Once a resort.
Calhoun Springs, near Pittsborough, Calhoun County.	.....	.....	.....	.....	Do.
Castalian Springs, near Durant, Holmes County.	5	7,200	58	Sulphureted, saline, and chalybeate.	Used as a resort and commercially.
Chalybeate Acid Springs, 2 miles southwest of Grenada, Grenada County.	1+	.....	75	Chalybeate, &c.	Used as a resort to a limited extent and sold.
<i>Chalybeate springs:</i> Near Poplar Springs, Calhoun Co.	.....	.....	.....	.....	Unimproved.
In T. 1. R. 16, southeast of De Soto, Clarke County.	.....	.....	.....	.....	
Near Enterprise, Clarke County.	.....	.....	64.4	.....	
Near Fulton, Itawamba County..	2	.....	62	.....	
*Southeast of Fulton, Itawamba Co.	.....	.....	.....	Chalybeate .....	
Near Eureka Springs, Panola Co.	.....	.....	.....	.....	
Near Warren's Mill, on Mackay's Creek, Tishomingo County.	.....	.....	.....	.....	
In Winston County .....	.....	.....	.....	.....	
In Yalobusha County .....	.....	.....	.....	.....	
In Sec. 26, T. 6, R. 9 E., Tishomingo County.	.....	.....	.....	.....	
In Sec. 34, T. 5, R. 10 E., Tishomingo County.	.....	.....	.....	.....	
North of Houston, Chickasaw Co.	.....	.....	.....	.....	
Near Jonesboro', Tippah County.	.....	.....	.....	.....	
Six miles northwest of Ripley, Tippah County.	.....	.....	.....	.....	
Southwest of Satartia, Yazoo Co.	.....	.....	75.2	.....	
One mile south-southwest of Grenada, Grenada County.	.....	.....	.....	.....	
Near Louisville, Winston County.	.....	.....	.....	.....	
Near Oxford, La Fayette County.	.....	.....	.....	.....	
Near Robina, Panola County .....	.....	.....	.....	.....	
Three miles northeast of Vernal, Greene County.	.....	.....	.....	.....	
Near Cross Roads, Greene County	.....	.....	.....	.....	
Near Westville, Simpson County.	.....	.....	.....	.....	
In Rankin County .....	.....	.....	.....	.....	
Coleman's Well, Jackson County ..	.....	.....	.....	.....	
Columbia Springs, Columbia, Marion County.	.....	.....	.....	.....	
Cooper's Well (artesian), 4 miles from Raymond, Hinds County.	1	.....	55	Saline .....	Used commercially and as a resort.
Franklin Springs, head of Well's Creek, Franklin County.	.....	.....	64	.....	Once a resort.
Godbold Mineral Well, near Summit, Pike County.	1	.....	.....	.....	Used commercially and as a resort.
Greenwood Spring, Monroe County.	.....	.....	.....	.....	
Harrison Springs (see Belmont Springs).	.....	.....	.....	.....	
Hazel Dell Springs, 2½ miles from Holly Springs, Marshall County.	3	.....	.....	Chalybeate .....	Used as a local resort.

*Mineral springs of Mississippi—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Holsom-Back Springs, 8 or 10 miles southwest of Louisville, Winston County.	.....	.....	o	.....	Local resort.
Iuka Mineral Springs, near Iuka, Tishomingo County.	4	.....	60	Chalybeate and sulphureted.	Resort.
La Fayette Springs, La Fayette Springs, La Fayette County.	.....	.....	.....	Saline, sulphureted.	Do.
Lauderdale Springs, near Lauderdale Station, Lauderdale County.	.....	.....	.....	Sulpho-chalybeate.	.....
<i>Mineral springs:</i>	.....	.....	.....	.....	.....
Near Poplar Springs, Union County.	.....	.....	.....	.....	Unimproved.
At Holmes Mill, near Fearn's Springs, Winston County.	.....	.....	.....	.....	Once a resort.
Near Corinth, Alcorn County	.....	.....	.....	.....	.....
In Sec. 24, T. 16, R. 3 E., Holmes County.	.....	.....	60.8	Acid-chalybeate	.....
At Pittsborough, Calhoun Co.	.....	.....	63	.....	.....
At Mount Pleasant, Marshall Co.	.....	.....	.....	Sulpho-chalybeate.	.....
At Canton, Madison County	.....	.....	.....	.....	.....
Near Brandon, Rankin County	.....	.....	.....	.....	.....
Near Steen's Creek, Rankin County.	.....	.....	.....	.....	.....
At West Pascagoula, Jackson County.	.....	.....	.....	.....	.....
Near Handsborough, Harrison County.	.....	.....	.....	.....	.....
In Sec. 30, T. 6, R. 9, near Hazel Dell, Prentiss County.	2	.....	.....	Sulpho-chalybeate.	Used locally.
Twelve miles northeast of Columbus, Lowndes County.	.....	.....	.....	.....	.....
Mineral Wells, 8 miles below head of Well's Creek, Franklin County.	.....	.....	.....	.....	.....
Mississippi Springs (once Bankston Springs), near Raymond, Hinds County.	4	.....	.....	Sulphureted	Used as a resort prior to 1868
Multona Springs, 4 miles from McCool, Attala County.	7	.....	.....	.....	Unimproved.
Ocean Springs, Ocean Springs, Jackson County.	.....	.....	.....	.....	Resort.
Quitman Red Sulphur Springs, or Archusa Springs, $\frac{3}{4}$ mile south of Quitman, Clarke County.	2	500+	.....	Sulpho-chalybeate.	Local resort.
Smith's Springs, south of Quitman, Clarke County.	.....	.....	.....	.....	.....
St. Andrew's Well, 1 mile south of Monticello, Lawrence County.	.....	.....	.....	.....	.....
St. Ronan's Well, 4 miles south of Monticello, Lawrence County.	.....	.....	.....	.....	.....
Stovall's Spring, 3 miles above Columbia, Marion County.	1	.....	.....	Chalybeate	Used to a limited extent for medicinal purposes.
<i>Sulphur springs:</i>	.....	.....	.....	.....	.....
Near Enterprise, Clarke County.	.....	.....	.....	.....	.....
Eight miles south of Philadelphia, Neshoba County.	1	.....	.....	.....	.....
Near Philadelphia, Neshoba Co.	1	.....	.....	.....	.....
Near Central Academy, Panola Co. In Neshoba County.	.....	.....	.....	.....	.....
Tipton Well, Jackson County	.....	.....	.....	.....	.....
Vernal Springs, 3 miles south of Vernal, Greene County.	.....	.....	.....	.....	Unimproved.
Winston Springs, near Louisville, Winston County.	.....	.....	.....	.....	Resort.
White Springs, $3\frac{1}{2}$ miles northwest of Ripley, Tippah County.	2	.....	40	.....	Used locally.
White's Springs, $\frac{4}{5}$ miles south of Fulton, Itawamba County.	3	.....	.....	.....	Local resort.
White Sulphur Springs, near Garlandville, Jasper County.	.....	.....	.....	.....	.....

*Analyses of mineral springs in Mississippi.*

Constituents.	Godbold Mineral Well.	Cooper's Well.	Lauderdale Springs.	Ocean Springs.
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Parts in 100.<sup>c</sup></i>	<i>Grains per gallon.<sup>b</sup></i>
Calcium carbonate.....	Trace			
Sodium sulphate.....		11.71		
Potassium sulphate.....		0.61		
Calcium sulphate.....	Trace	32.13		
Aluminium sulphate.....		6.12		
Magnesium sulphate.....		23.28		
Sodium chloride.....	1.73	8.36		47.77
Potassium chloride.....				Trace
Calcium chloride.....		4.32		3.88
Magnesium chloride.....		3.48		4.97
Iron protochloride.....	11.42			
Silica.....	Trace		0.00100	
Alumina.....			0.00005	
Ferrous oxide.....				4.71
Loss.....	0.84			
Iron peroxide.....		3.36	0.00047	
Crenate of lime.....		0.31		
Crenate of silica (?).....		1.80		
Organic matter.....				Trace
Lime.....			0.00014	
Sulphur combined with hydrogen.....			0.00034	
Potash.....			0.00012	
Soda.....			0.00226	
Ammonia.....			Trace	Trace
Magnesia.....			Trace	
Sulphuric acid.....			0.00008	
Carbonic acid.....			0.00007	
Chlorine.....			0.00062	
Iodine.....			0.00006	Trace
Apocrenic acid.....			0.00008	
Crenic acid.....			0.00002	
Hydrogen combined sulphate.....			0.00002	
Bromine.....			Trace	
Total.....	13.99	95.48	0.00533	61.33
<i>Gases.</i>				<i>Cubic inches.</i>
Sulphureted hydrogen.....			0.23397	1.28
Carbonic acid uncombined.....			0.25766	9.76
Oxygen and nitrogen.....			0.25728	
Carbureted hydrogen.....			Trace	
Total.....			0.74891	

<sup>a</sup> J. H. Laster, analyst.<sup>b</sup> J. Lawrence Smith, analyst.<sup>c</sup> L. Harper, analyst (1857).

## TENNESSEE.

The mineral springs of Tennessee are numerous and occur in all portions of the State. The geological formations being the same as those of the adjacent States, especially of Virginia, Kentucky, Alabama, and Mississippi, the mineral springs are naturally of the same general character. Chalybeate and sulphureted springs, therefore, predominate. Killebrew and Safford's Resources of Tennessee probably gives as complete an enumeration of the springs as any work published. The list presented here is largely indebted to it, and in addition has had the supervision of Prof. James M. Safford, State geologist of Tennessee. Acknowledgment is also due to him for copies of analyses made by himself and by Prof. N. T. Lupton.

A large number of the springs are used as resorts. Many that were so frequented prior to the war have fallen into disuse, and other springs

of extensive local reputation are still unimproved. Notwithstanding the number of springs utilized, complete analyses of comparatively few have been made:

*Mineral springs in Tennessee.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Alleghany Springs, 14 miles south of Maryville, Blount County.	3	300+	59	Chalybeate, sulphureted.	Resort.
Alum and Chalybeate Springs, on Beaver Dam Creek, Benton County.	.....	.....	.....	.....	.....
Alum Springs, near Rogersville, Hawkins County.	3	.....	.....	.....	.....
Alum Well, 5 miles east of Rogersville, Hawkins County.	1	.....	.....	.....	Unimproved.
Artesian Well (sulphur), 2 miles from Saltillo and 3 mile north of White Oak River, Hardin County.	.....	.....	.....	Sulphureted	.....
Artesian Well, Swayne's Mineral Spring, 9 or 10 miles from mouth of Big Sandy and 4 miles from Springville, Henry County.	1	.....	.....	Sulphureted	Was once a famous resort; not much used at present.
Austin's Springs, Austin's Springs, Washington County.	2	60	51	Saline, chalybeate.	Resort.
Avoca Spring, near Bristol, Sullivan County.	1	50	.....	Sulphureted	Used locally.
Banner's Springs, 4 miles from Dandridge, Jefferson County.	.....	.....	.....	Sulphureted	Resort.
Bath Springs, Decatur County, 7 miles northwest of Clifton.	2	.....	.....	Sulphureted	Was once a resort; unimproved now.
Beaver Dam Springs, southern part of Hickman County.	.....	.....	.....	Sulphureted	Resort.
Beersheba Springs, Beersheba Springs, Grundy County.	.....	.....	.....	Chalybeate	Do.
Black Sulphur Springs, Blount County.	.....	.....	.....	.....	.....
Black Water Springs, near Bean's Station, Grainger County.	3	.....	.....	Sulphureted and chalybeate.	Do.
Bon Air Chalybeate Spring, on edge of Cumberland tableland, 5 miles from Sparta, White County.	.....	.....	.....	Chalybeate	Resort prior to the war.
Bon Aqua Springs, formerly Weem's Springs, Hickman County, 7 miles south of Burns.	.....	.....	.....	Calcic, sulphur	Resort.
Brown's Springs, near Union Depot, Sullivan County.	.....	.....	.....	.....	.....
Brown and Boyd's Spring, Rhea Co., 5 miles from Pikeville.	.....	.....	.....	Chalybeate	.....
Canwood's Springs, 2 miles south of Dandridge, Jefferson County.	.....	.....	.....	Chalybeate and sulphureted.	Do.
Cascade Springs (formerly Pylant's), Franklin Co., 5 miles from Tullahoma.	6	.....	.....	Alkaline, sulphureted.	Do.
Castalian Springs, Castalian Springs, Sumner County.	6	12,000+	.....	Saline, sulphureted.	Was a resort to limited extent before the war.
Cave's Springs, 6 miles from Franklin, Williamson County.	.....	.....	.....	.....	Resort.
<i>Chalybeate springs:</i>					
In Washington County	.....	.....	.....	Chalybeate	.....
Near Huntingdon, Carroll County.	.....	.....	.....	.....	.....
Near Jacksborough, Campbell Co.	.....	.....	.....	.....	.....
At Elizabethton, Carter County	.....	.....	.....	.....	.....
Two miles south of Crossville, Cumberland County.	.....	.....	.....	.....	.....
Ten miles south of Crossville, Cumberland County.	.....	.....	.....	.....	.....
Near Rockport, Benton County	.....	.....	.....	.....	.....
Four miles from Pikeville, Bledsoe Co.	1	.....	.....	.....	Unimproved.
East of Smithville, De Kalb Co.	2	10+	.....	Sulpho-chalybeate.	.....
In Fentress County	.....	.....	.....	.....	.....
In Hardin County	.....	.....	.....	.....	.....
Two miles east of Paris, Henry Co.	.....	.....	.....	.....	Used locally.
In Big Poor Valley, northeast of War Gap, Hawkins County.	.....	.....	.....	.....	.....

## Mineral springs in Tennessee—Continued.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Chalybeate springs—Continued.</i>			o		
At Mill Spring, Jefferson County.					
Ten miles south of Dandridge, Jefferson County.					
Near Jasper, Marion County.					
Twenty miles southeast of Livingston, Overton County.	1				
On Roaring Fork, Overton County.					
At Alpine, Overton County.	1				
Near Jackson, Madison County.	3				Resort.
At Pilot Knob, near Monroe, Overton County.	1				
On Turkey Creek, Madison County.					
In Wear's Valley, south of Sevierville, Sevier County.					
In Sullivan County.					
One mile south of Spencer, Van Buren County.					
Chilhowee Spring, Chilhowee Mountain, near Williamsburg, 1 mile south of Kimbrough's Store, McMinn Co.	1	300-400		Chalybeate	Used to small extent locally.
Clinchdale Springs, Bean's Station Valley, Grainger County.	12			Chalybeate and sulphureted.	Unimproved.
Clarktown Springs, Clarktown, 11 miles east of Sparta, White County.	4			Chiefly chalybeate.	Resort.
Cooper's Springs, 1½ miles east of Kimbrough's Store, McMinn Co.					
Copeland Springs, near White Pine, 6 miles east of Dandridge, Jefferson County.				Sulphureted and chalybeate.	Do.
Crawford Spring, Henderson County, 16 miles east of Jackson.					
Crisp Springs, 6 miles from McMinnville, Warren County.				Alkaline, sulphureted.	
Dixon's Oakland Spring, 2 miles from Fern River, near Perryville, Decatur County.	1	300		Sulphureted	Used locally.
Draper's Springs, Bloomington, Putnam County.	3		57	Chalybeate and sulphur.	Resort.
Dunlap's Chalybeate Springs, 2½ miles south of Bolivar, Hardeman County.	4			Sulphur and chalybeate.	Was a resort prior to the war.
Dunn's Spring, Davidson County.					
Eldorado Springs, Chancy, Robertson County.	6			Sulphureted	Resort.
Elkmount Springs, near Elkton, Giles Co.	3+		57-60	Chalybeate	Do.
Epperson Springs, west part of Macon County.	5		40	Chalybeate and sulphur.	Do.
Epsom Springs, 7 miles northeast of Rogersville, Hawkins County.					
Erwin Spring, Erwin, Unicoi Co.	1	200+		Chalybeate	Do.
Estill Springs, Spring Hill, Estill Springs, Franklin County.	3			Chalybeate and alkaline, sulphureted.	Used as a resort to limited extent.
Fernvale Springs (formerly Smith's), 12 miles west of Franklin, Williamson County.	3	45+	63½	Sulphureted and calcic.	Resort.
Galbraith's Springs, Galbraith's Springs, near Mooresburg, Hawkins County.	4	60+		Chalybeate	Do.
Gibson's or Academy Springs, 18 miles east of Crossville, Cumberland Co.	3				Unimproved.
Gibson Wells, 9 miles southwest of Trenton, Gibson County.	3				Resort.
Glenn's Chalybeate Spring, 1½ miles east of Randolph and 7 miles west of Atoka, Tipton County.	1			Alkaline, carbonated.	Do.
Glover's Springs, near Union Depot, Sullivan County.	2	200		Chalybeate	Do.
Graham's Springs, near Rebecca, Franklin County.				Calcic, alkaline, sulphureted.	Do.
Hager's Spring, Sumner County.				Sulphureted	
Hale's Red and White Sulphur Springs, Hale's Springs, 6 miles northwest of Rogersville, Hawkins County.	3		58	Sulphureted and chalybeate.	Do.

*Mineral springs in Tennessee—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Hale and Goff's Springs, near Spencer, Van Buren County.	.....	.....	o	.....	.....
Harris Sulphur Springs, 2 miles from Ashland City, Cheatham County.	.....	.....	.....	.....	.....
Henderson's Springs, Henderson's Springs, Sevier County.	.....	.....	.....	.....	.....
Hinson Spring, Henderson County, 28 miles east of Jackson.	1	.....	.....	Chalybeate	Resort.
Horn's Mineral Springs, near Lebanon, Wilson County.	.....	.....	.....	Alkaline, saline	Resort and the water is sold to limited extent.
Howard Springs, Howard Springs, 4 miles west of Crossville, Cumberland County.	4	400+	45-50	Chalybeate	Resort.
Hurricane Springs, Franklin County, 6 miles from Tullahoma.	3	12	54	Alkaline, sulphureted.	Sold to limited extent and a resort.
Idaho Springs, Saint Bethlehem, near Clarksville, Montgomery County.	6	60+	56	.....	Used commercially and as a resort.
Jenkins White Sulphur Springs, Carter County.	.....	.....	.....	.....	.....
Jones's Sulphur Well, 1 mile west of Murfreesborough, Rutherford Co.	.....	.....	.....	Alkaline, sulphureted.	.....
Jordan's Springs, Jordan's Springs, Montgomery County.	8	6,000+	40	.....	Used locally.
King's Sulphur Springs, Cheatham Co.	.....	.....	.....	.....	.....
Kingston Springs, Kingston Springs, Cheatham County.	5	.....	57-60	Sulphureted and chalybeate.	Resort.
Klippert's Spring, near Hale's Springs, Hawkins County.	1	.....	.....	Chalybeate	Do.
Lea's Springs, near Spring House, Grainger County.	7	.....	.....	.....	Do.
Line Spring, Line Spring, Sevier Co.	1	.....	.....	Chalybeate	Local resort.
Low's Sulphur Springs, near Fairview, Anderson County.	.....	.....	.....	.....	Unimproved.
Mack's Sulphur Springs, 6 miles south of Maryville, Blount County.	.....	.....	.....	.....	Improved.
McBride's Spring, 3 miles from Spencer, Van Buren County.	1	60	.....	.....	Local resort.
McEwen's Springs, 1 mile from Franklin, Williamson County.	.....	.....	.....	.....	Resort.
Melrose Springs, near Maryville, Blount County.	4	.....	.....	Sulphureted and chalybeate.	Do.
<i>Mineral springs:</i>					
Near Pikeville, Bledsoe County	.....	.....	.....	Chalybeate	.....
In Cocke County	.....	.....	.....	Chalybeate, &c.	.....
At foot of Cumberland Gap, Claiborne County.	.....	.....	.....	.....	.....
Two miles west of Alamo, Crockett County.	.....	.....	.....	.....	.....
In James County	.....	.....	.....	.....	.....
Near Chestnut Hill, Jefferson Co.	.....	.....	.....	.....	.....
In Poor Valley, Knox County	.....	.....	.....	.....	.....
In McMinn County	.....	.....	.....	.....	.....
Near Mont Eagle, Marion Co.	4	.....	.....	.....	Do.
In Perry County	.....	.....	.....	.....	.....
In Putnam County	.....	.....	.....	.....	.....
At Neshoba, Shelby County	.....	.....	.....	.....	.....
At Raleigh, Shelby County	.....	.....	.....	.....	.....
On Clinch River, Union County.	.....	.....	.....	Sulphur	Unimproved.
Six miles north of Maynardville, Union County.	.....	.....	.....	Chalybeate	Do.
Mineral Hill Springs, near Bean's Station, Grainger County.	8	400+	.....	Sulphureted	Used commercially and as a resort.
Montvale Springs, Montvale, Blount County.	3	200+	45-50	Chalybeate and sulphur.	Resort.
Mooresburg Spring, near Mooresburg, Hawkins County.	.....	.....	.....	Chalybeate	Do.
Morgan Springs, Rhea County, 6 miles from Pikeville, Bledsoe County.	.....	.....	.....	do	.....
Mount Nebo Springs, Blount County	.....	.....	.....	.....	.....
Nashville Sulphur Spring (artesian), Nashville, Davidson County.	.....	.....	.....	Saline, sulphureted.	Much used by people of Nashville.
Norwood Springs, Rhea Co., 1½ miles from Pikeville, Bledsoe County.	.....	.....	.....	Chalybeate	.....

*Mineral springs in Tennessee—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Oliver Springs, Oliver Springs, Anderson County.	6	150+	.....	Sulphureted and chalybeate.	Resort.
Parker's Sulphur Spring, near Big Sandy, Benton County.	1	.....	.....	.....	Local resort.
Patterson's Springs, near Birdsville, Cocke County.	.....	.....	.....	.....	Resort.
Pettigrew White Sulphur Springs, 9 miles from Perryville, Decatur Co.	.....	.....	.....	.....	Do.
Pickwick White and Red Sulphur Springs, near Walnut Grove, Hardin County.	.....	.....	.....	.....	.....
Powder Springs, Powder Spring Gap, Grainger County.	.....	.....	.....	.....	Unimproved at present.
Primm's Springs, east part of Hickman County.	5	515+	58-68	Calcic, sulphureted.	Resort.
Price's Chalybeate Spring, 6 miles from Erie, Loudon County.	1	.....	.....	Chalybeate.	Local resort.
Raleigh Mineral Springs, Raleigh, near Memphis, Shelby County.	6+	.....	53-74	.....	.....
Red Boiling Springs, Red Boiling Springs, Macon County.	3+	.....	.....	Sulphureted and chalybeate.	Used commercially and as resort.
Red Sulphur Springs, 5 miles south of Pyburn's Bluff, Hardin County.	3	.....	.....	.....	.....
Rhea Springs, Rhea Springs, Rhea County.	2	480	56	Alkaline, saline, chalybeate.	Used commercially and as a resort.
Robinson's Springs, 20 miles from Nashville, Davidson County.	.....	.....	.....	.....	.....
Robinson Spring, Chalybeate, Van Buren County.	1	120	.....	Chalybeate.	Resort.
Sam's Creek Springs, Davidson Co.	.....	.....	.....	.....	.....
Shady Grove Springs, 4 miles southwest of Dandridge, Jefferson Co.	.....	.....	.....	Chalybeate and sulphureted.	Do.
Shelby Chalybeate Springs, Nashville, Davidson County.	.....	.....	.....	.....	.....
South Saratoga Springs, 10 miles from Pikeville, Bledsoe County.	.....	.....	.....	.....	Do.
<i>Sulphur springs:</i>					
On Sulphur Creek, Benton County.	1	60	51	.....	Local resort.
In Clay County	.....	.....	.....	.....	Small and unimportant.
At Cascade Falls, near Tullahoma, Coffee County.	.....	.....	.....	.....	.....
Three miles from Stephen's Chapel, Bledsoe County.	.....	.....	.....	.....	Unimproved.
In Dyer County	.....	.....	.....	.....	.....
At Van Buren Academy, Fentress County.	.....	.....	.....	.....	.....
Near Locust Spring, Greene Co.	.....	.....	.....	.....	.....
In Hamblen County	.....	.....	.....	.....	Do
Three miles from Saltillo, Hardin County.	1	100	.....	.....	.....
Four miles west of Dandridge, Jefferson County.	.....	.....	.....	.....	.....
Four miles south of White Pine, Jefferson County.	1	.....	.....	.....	Resort.
Seven miles south of Livingston, Overton County.	.....	.....	.....	.....	Local resort.
Near Jefferson, Rutherford Co.	.....	.....	.....	.....	.....
Near Murfreesborough, Rutherford County.	.....	.....	.....	.....	.....
Near Huntsville, Scott County	.....	.....	.....	.....	.....
Eight miles east of Blountville, Sullivan County.	.....	.....	.....	.....	.....
Five miles west of Union Depot, Sullivan County.	.....	.....	.....	.....	.....
In Tipton County	.....	.....	.....	.....	.....
Between Districts 7 and 10, Weakley County.	.....	.....	.....	.....	.....
<i>Sulphur wells:</i>					
At Alexandria, De Kalb County	.....	.....	.....	.....	.....
Near Liberty, De Kalb County	.....	.....	.....	.....	.....
Near Brentwood, Williamson Co.	.....	.....	.....	.....	.....
Near Nolensville, Williamson Co.	.....	.....	.....	.....	Unimproved.
Near Petersburg, (?) Williamson Co.	.....	.....	.....	.....	.....

*Mineral springs in Tennessee — Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Sulphur wells — Continued.</i>			°		
Three and one-half miles northeast of Sparta, White County.					
At Clarktown, near Solon, White Co.					
Tate's Epsom Spring, Tate Springs, Grainger County.	1	120	55	Saline, chalybeate.	Unimportant. Commercially and as a resort.
Terries Springs, Rutherford County.					
Tilford's Mineral Well, Wartrace, Bedford County.				Alkaline.	
Tyree's Springs, Davidson County.					
Wayland's Springs, Wayland Springs, Lawrence County.	4	150+	60	Saline, chalybeate.	Resort.
West Nashville Sulphur Well, Nashville, Davidson County.				Saline, sulphureted.	Sold to limited extent.
Winchester Sulphur Springs, Franklin County.					Resort prior to the war.
White Cliff Springs, in Chilhowee Mountain, 16 miles from Mouse Creek, Monroe County.	3+			Chalybeate, sulphureted.	Resort. (?)
White Creek Springs, 12 miles from Nashville, Davidson County.				Sulphureted	Resort.
White Fern Springs, Henderson Co., 14 miles east of Jackson.					
White Sulphur Spring, near Witt's Foundry, Hamblen County.	1		45	Sulphureted	Unimproved.
White Sulphur Spring, 1 mile south of Pyburn's Bluff, Hardin County.	1	20			Resort.
White Sulphur Springs, in Sumner County, near Whitehouse.					
Wood's Springs, near Miles Cross-Roads, Clay County.	3				Used locally.
Yeager's Springs, Washington County.	2				
Yellow Sulphur Springs, near Montvale, Blount County.					
Yellow Sulphur Springs, Carter Co.					

*Analyses of mineral springs in Tennessee.*

Constituents.	Austin's Springs.	Cascade or Pylant's Springs.	Crisp Springs.	Fernvale Springs.	Galbraith's Springs.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>e</sup></i>
Sodium carbonate .....	.....	.....	6.30	.....	.....
Calcium carbonate .....	3.20	9.23	16.91	6.48	3.84
Magnesium carbonate .....	.....	5.52	1.43	7.04	0.47
Lithium carbonate .....	.....	.....	Trace	.....	Trace
Iron carbonate .....	Trace	.....	.....	.....	0.41
Sodium sulphate .....	2.40	12.68	.....	13.76	0.22
Calcium sulphate .....	4.80	4.05	23.45	27.60	0.91
Magnesium sulphate .....	11.20	.....	15.17	.....	.....
Potassium sulphate .....	.....	2.35	0.78	1.12	0.16
Lithium sulphate .....	.....	.....	.....	Trace	.....
Iron sulphate .....	6.40	.....	.....	.....	.....
Sodium hyposulphite .....	.....	.....	0.89	.....	.....
Calcium nitrate .....	.....	.....	.....	.....	Trace
Sodium phosphate .....	.....	.....	Trace	.....	.....
Calcium phosphate .....	.....	0.04	.....	.....	Trace
Sodium sulphide .....	.....	9.76	1.35	8.32	.....
Iron sulphide (in suspension) ..	.....	.....	Trace	.....	.....
Sodium chloride .....	0.80	14.15	5.45	8.88	0.08
Lithium chloride .....	.....	0.22	.....	.....	.....
Magnesium iodide .....	.....	0.05	.....	.....	.....
Magnesium bromide .....	.....	0.56	.....	.....	.....
Aluminium oxide .....	2.00	}	0.06	}	0.04
Iron oxide .....	11.20		.....		.....
Silica .....	.....	0.58	0.41	0.08	0.68
Iodine .....	Trace	.....	Trace	.....	.....
Bromine .....	.....	.....	Trace	.....	.....
Loss .....	4.00	.....	.....	.....	.....
Total .....	46.00	59.88	77.20	73.84	6.81
<i>Gas.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Sulphureted hydrogen .....	.....	23.04	9.47	14.64	.....

<sup>a</sup>Alpheus Dove, analyst.<sup>b</sup>N. T. Lupton, analyst (1877).<sup>c</sup>J. M. Safford, analyst (1884).<sup>d</sup>N. T. Lupton, analyst (1879).<sup>e</sup>W. A. Noyes, analyst (1884).

*Analyses of mineral springs in Tennessee—Continued.*

Constituents.	Glenn's Chalybeate Spring.	Hurricane Springs.	Jones's Sul- phur Well.	Montvale Springs.	
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>e</sup></i>
Sodium carbonate.....	1.58	6.48	7.74	.....	.....
Calcium carbonate.....	9.64	6.95	4.85	13.26	.....
Magnesium carbonate.....	7.10	3.98	2.17	.....	.....
Potassium carbonate.....	0.05	.....	.....	.....	.....
Lithium carbonate.....	.....	.....	0.02	.....	.....
Strontium carbonate.....	.....	.....	Trace	.....	.....
Iron carbonate.....	0.54	.....	.....	2.40	.....
Sodium sulphate.....	.....	4.29	.....	4.51	8.82
Calcium sulphate.....	.....	.....	.....	74.21	81.94
Magnesium sulphate.....	.....	.....	.....	12.00	17.07
Potassium sulphate.....	0.27	2.08	2.13	.....	.....
Sodium hyposulphite.....	.....	0.32	3.74	.....	.....
Sodium phosphate.....	.....	0.01	Trace	.....	.....
Calcium phosphate.....	0.01	.....	.....	.....	.....
Sodium biborate.....	.....	Trace	.....	.....	.....
Sodium sulphide.....	.....	.....	7.13	.....	.....
Sodium bisulphide.....	.....	5.86	.....	.....	.....
Iron sulphide (in suspension) ..	.....	Trace	Trace	.....	.....
Sodium chloride.....	0.16	12.93	1.01	1.96	.....
Magnesium chloride.....	.....	.....	.....	.....	0.10
Calcium chloride.....	.....	.....	.....	.....	0.14
Lithium chloride.....	.....	0.06	.....	.....	.....
Sodium iodide.....	.....	Trace	.....	.....	.....
Sodium bromide.....	.....	Trace	.....	.....	.....
Aluminium oxide.....	.....	0.29	Trace	0.50	.....
Iron oxide.....	.....	.....	.....	.....	1.19
Silica.....	1.38	0.50	.....	.....	Trace
Iodine.....	.....	.....	1.46	.....	.....
Bromine.....	.....	.....	Trace	.....	.....
Organic matter.....	.....	.....	.....	.....	0.04
Total.....	20.73	43.75	30.25	108.84	109.30
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Sulphureted hydrogen.....	.....	1.16	1.17	.....	.....
Carbon dioxide.....	14.64	14.26	14.75	.....	.....

<sup>a</sup> N. T. Lupton, analyst (1880).<sup>b</sup> J. M. Safford, analyst.<sup>c</sup> J. M. Safford, analyst (1884).<sup>d</sup> J. B. Mitchell, analyst.<sup>e</sup> J. R. Chilton, analyst.

## Analyses of mineral springs in Tennessee—Continued.

Constituents.	Raleigh Mineral Springs.					
	Beach Spring.	Box Spring.	Freestone Spring.	Magnolia Spring.	Marble Spring.	Bayless Spring.
	<i>Grams in 10,000.<sup>a</sup></i>	<i>Grams in 10,000.<sup>a</sup></i>	<i>Grams in 10,000.<sup>a</sup></i>	<i>Grams in 10,000.<sup>b</sup></i>	<i>Grams in 10,000.<sup>a</sup></i>	<i>Grams in 10,000.<sup>b</sup></i>
Calcium carbonate .....		0.201		0.580	0.060	0.306
Magnesium carbonate .....				0.264	Trace.	0.097
Magnesium bicarbonate .....		0.044	0.143			
Iron protocarbonate .....	0.421	0.296	0.042	0.631	0.193	1.182
Sodium sulphate .....		0.142		0.069	0.214	0.525
Calcium sulphate .....			0.175			
Magnesium sulphate .....				0.070		0.037
Potassium sulphate .....		0.077			0.356	
Aluminium sulphate .....	<sup>c</sup> Trace	0.153			0.086	
Sodium chloride .....	0.275	0.190	0.132	0.102	0.146	0.190
Magnesium chloride .....	0.083		0.003			
Calcium chloride .....	0.235		0.135			
Potassium chloride .....	0.015		0.078			
Aluminium oxide .....				( <sup>c</sup> )		( <sup>d</sup> )
Silica .....				0.262		0.377
Carbonic acid (free) .....	2.003	1.793	1.005	2.887	0.450	2.491
Organic matter .....			<sup>e</sup> Present	0.337		0.709
<b>Total .....</b>	<b>3.032</b>	<b>2.896</b>	<b>1.713</b>	<b>5.202</b>	<b>1.505</b>	<b>5.914</b>

Constituents.	Primm's Springs: Spring No. 2.	Red Boiling Springs.	Rhea Springs.	Tate's Epsom Spring.	Tilford's Mineral Well.
	<i>Grains per gallon.<sup>f</sup></i>	<i>Grains.<sup>g</sup></i>	<i>Parts in 1,000,000.<sup>h</sup></i>	<i>Grains per gallon.<sup>i</sup></i>	<i>Grains per gallon.<sup>j</sup></i>
Sodium carbonate .....					22.59
Calcium carbonate .....	0.85	26.00		21.56	0.62
Magnesium carbonate .....	0.91				0.17
Lithium carbonate .....					Trace
Iron bicarbonate .....			616		
Sodium sulphate .....	5.22		513	8.50	6.22
Calcium sulphate .....	32.87	6.00	600	160.66	
Magnesium sulphate .....	29.81	8.00	234	31.91	
Potassium sulphate .....	1.72			1.54	0.39
Iron protosulphate .....	Trace				
Sodium hyposulphite .....					1.02
Sodium phosphate .....					Trace
Calcium phosphate .....				1.14	
Magnesium phosphate .....	2.10				
Sodium baborate .....					Trace
Sodium sulphide .....	} 2.57 {				0.45
Magnesium sulphide .....					
Sodium chloride .....	5.48	1.00	23	40.27	4.49
Manganese chloride .....				0.66	
Iron chloride .....				2.92	
Sodium iodide .....				Trace	
Aluminium oxide .....					0.06
Iron protoxide .....		2.50			
Silica .....		1.50		2.70	0.15
Nitric acid .....				0.02	
Carbonic acid (free) .....		15.00			
Iodine .....					Trace
Bromine .....					Trace
Organic matter .....			91		
<b>Total .....</b>	<b>81.53</b>	<b>60.00</b>	<b>20.77</b>	<b>271.88</b>	<b>36.16</b>
<b>Gases.</b>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbon dioxide .....			Large am't	Present	14.00
Sulphureted hydrogen .....		4.50			Trace
Carbureted hydrogen .....					Present

<sup>a</sup>Enno Sander, analyst (1886).<sup>b</sup>Theodore Hoerner, analyst.<sup>c</sup>Traces of silicate and phosphate of alumina.<sup>d</sup>Traces of silicate of alumina.<sup>e</sup>Traces of nitrogen.<sup>f</sup>A. B. Rains, analyst (1879).<sup>g</sup>J. M. Safford, analyst.<sup>h</sup>William Baker, analyst.<sup>i</sup>T. S. Antisell, analyst (1872).<sup>j</sup>J. M. Safford, analyst (1884).

*Analyses of mineral springs in Tennessee—Continued.*

Constituents.	West Nashville Sulphur Well.	White Cliff Springs.	White Creek Springs.	West End Mineral Water, Nashville.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>b</sup></i>
Sodium carbonate.....	9.26			19.184
Calcium carbonate.....	13.21		35.42	2.272
Calcium bicarbonate.....		1.47		
Magnesium carbonate.....	5.06			5.144
Magnesium bicarbonate.....		2.89		
Potassium carbonate.....				1.040
Lithium carbonate.....	Trace			Trace
Iron bicarbonate.....		1.93		
Sodium sulphate.....	14.31		13.20	
Calcium sulphate.....		1.51	19.64	15.304
Magnesium sulphate.....			19.32	
Potassium sulphate.....	2.14			
Sodium hyposulphate.....			6.50	
Sodium sulphide.....	11.85			16.368
Sodium chloride.....	66.65	0.92		66.272
Potassium chloride.....		0.56		
Aluminium oxide.....		0.08		
Iron oxide.....	} 0.07 {			} .072 {
Silica.....		1.12		
Iodine.....	Trace			Trace
Bromine.....	Trace			Trace
Total.....	122.55	10.48	94.08	125.656
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbon dioxide.....			37.996	
Sulphureted hydrogen.....	5.840		40.25	0.730

<sup>a</sup>N. T. Lupton, analyst (1883).<sup>b</sup>Troost, analyst (1841).<sup>c</sup>N. T. Lupton, analyst (1884).

## KENTUCKY.

The State of Kentucky occupies a prominent place as a mineral spring region, not only from the number of springs, but also on account of the quality of the waters. Some of them are among the most remarkable in the country and many are on sale in the East, West, North, and South. Such are the celebrated Blue Lick water and that of the Crab Orchard springs. There are said to be two great water beds in Kentucky, viz: the calciferous sandstone, underlying the Silurian rocks, and the great sandstone formation at the base of the Coal Measures, and any localities in counties within the range of those formations (Silurian and Carboniferous), if not already possessed of mineral springs, can have artesian mineral wells by boring from 150 to 300 feet. Still the mineral waters do not appear to be confined to these beds, although possibly more abundant in them. Our list mentions springs as occurring in nearly two-thirds of the counties, and the remaining counties are not confined to any one portion of the State; so that it is possible that, if the information relating to them were more complete, they also might be included among those having mineral springs.

The great majority of the springs are still unimproved, although many are used as local resorts, especially during the summer season. The reports of the Kentucky geological survey are quite complete in the

description of the mineral springs of the State, and Dr. Peters's chemical reports on them have furnished a large proportion of the analyses given in the tables in this paper. Davies's report on the resources of the State has also furnished considerable data.

*Mineral springs of Kentucky.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Allen Springs, Allen Springs, Warren County.	.....	.....	o	Sulphureted ....	Resort.
Alum Springs, near Esculapia Springs, Lewis County.	.....	.....	.....	.....	.....
Alum Springs, base of Burdett's Knob, Boyle County.	.....	.....	.....	Chalybeate .....	.....
Beachville Springs, Beachville, Metcalfe County.	2	.....	.....	Saline and sulphureted.	Local resort.
Bedford Springs, Bedford, Trimble County.	3	60	.....	Saline .....	Used commercially and as a resort.
Big Bone Lick Springs, Big Bone Lick, east of Hamilton, Boone Co.	3	.....	.....	Saline, sulphureted.	.....
Big Lick Springs, Gallatin County.	.....	.....	.....	do .....	.....
Blue Lick Spring (lower), Blue Lick Springs, Nicholas County.	1	300	62	Saline .....	Do.
Blue Lick Spring (upper), Davidson, Nicholas County.	1	1,200	60	Sulpho-saline ...	Used commercially.
Box Mountain Sulphur Springs, 4 miles west of Morton's Gap, Hopkins County.	.....	.....	63	Sulphureted ....	.....
Brown Spring, near Crab Orchard, Lincoln County.	.....	.....	.....	.....	.....
Bryant's Springs, near Crab Orchard, Lincoln County.	6	.....	.....	Chalybeate and saline sulphureted.	.....
Buena Vista Springs, northwest of Russellville, Logan County.	.....	.....	.....	.....	.....
Buffalo Springs, 15 miles southwest of Big Spring, Breckinridge Co.	.....	.....	.....	Sulphureted ....	.....
Burgher's Spring, near Russellville, Logan County.	1	30	55	Chalybeate .....	Resort.
Campbellville, Sulphur Spring, Campbellville, Taylor County.	.....	.....	.....	Saline, sulphureted.	.....
Cerro Gordo Springs, near Russellville, Logan County.	.....	.....	.....	.....	.....
Cerulean Springs, Cerulean Springs, north of Wallonia, Trigg County.	.....	60	56	Saline .....	.....
<i>Chalybeate springs:</i>					
Near Letcher Court-House, Letcher? County.	.....	.....	.....	.....	.....
Southeast of Morganfield, Union County.	.....	.....	.....	.....	.....
In Bath County .....	.....	.....	.....	.....	.....
In Bell County .....	.....	.....	.....	.....	.....
In Breathitt County .....	.....	.....	.....	.....	.....
In Bullitt County .....	.....	.....	.....	.....	.....
In Hancock County .....	.....	.....	.....	.....	.....
Four miles southwest of Hickman (Combs), Fulton County.	.....	.....	.....	.....	.....
In Pulaski County .....	.....	.....	.....	.....	.....
Near Eminence, Henry County ..	.....	.....	.....	Saline, chalybeate.	.....
In Perry County .....	.....	.....	.....	.....	.....
In Jackson County .....	.....	.....	.....	.....	.....
In Johnson County .....	.....	.....	.....	.....	.....
Near Cumberland Falls, Whitley County.	2	.....	.....	Carbonated, chalybeate.	.....
Chalybeate and Saline Springs, on Barnett's Creek, Ohio County.	.....	.....	.....	.....	.....
Chameleon Springs, south of Brownsville, Edmonson County.	.....	.....	.....	Sulphureted ....	.....
Clear Creek Sulphur Springs, near Pineville, Bell County.	.....	.....	.....	.....	.....

*Mineral springs of Kentucky—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Crab Orchard Springs, Crab Orchard, Lincoln County.	.....	.....	o	.....	Resort, and the evaporated salts used commercially.
Creel White Sulphur Spring, Marion County.	.....	.....	.....	Saline, sulphureted.	.....
Crittenden Spring, Crittenden Co....	1	75	61	Saline, carbureted.	.....
Davis Spring or Well, 5 miles northeast of Morton's Gap, Hopkins Co.	1	.....	.....	Saline, chalybeate.	Resort.
Drennon Springs, Drennon Springs, south of Port Royal, Henry County.	.....	.....	.....	Saline, sulphureted.	Once a resort.
Dripping Springs, Garrard County, 2 miles east of Crab Orchard.	5	400	55 to 56	Saline, chalybeate.	Resort.
Elliston's Sulphur Spring, Madison County.	.....	.....	.....	Saline, sulphureted.	.....
Epsom Spring, near Crab Orchard, Lincoln County.	.....	.....	.....	.....	.....
Epsom Spring, near Bedford, Trimble County.	.....	.....	.....	.....	.....
Esculapia Springs, Esculapia Springs, Lewis County.	3	.....	55	Chalybeate, sulphureted, &c.	Do.
Estill Springs, near Irvine, Estill County.	.....	.....	.....	Saline, sulphureted.	.....
Foley's Epsom Spring, near Crab Orchard, Lincoln County.	.....	.....	.....	.....	.....
Fox Springs, 10 miles from Flemingsburg, Fleming County.	6	.....	.....	Sulphureted	Do.
Grayson Springs, Grayson Springs, Grayson County.	100+	2,800+	58 to 67	do	Used commercially and as a place of resort.
Grigsby's (R. B.) White Sulphur Mineral Spring, Nelson County.	.....	.....	.....	Saline, sulphureted.	.....
Hardin Spring, Hardin Springs, Hardin County.	1	275	.....	Sulphureted	Resort.
Hardinsville Sulphur Springs, Hardinsville, Shelby County.	.....	.....	.....	do	.....
Harrodsburg Springs, Harrodsburg, Mercer County.	.....	.....	.....	Saline	.....
Hickman's Springs, south of Owensborough, Crow's Station, Daviess County.	6	.....	.....	Chalybeate, saline, and sulphureted.	.....
Howard's Sulphur Well, near Crab Orchard, Lincoln County.	.....	.....	.....	.....	.....
Howell Mineral Springs, Hardin County.	.....	.....	.....	Saline, chalybeate.	.....
Indian Spring, near Jones's Mill, Grayson County.	.....	.....	.....	.....	.....
Innis Sulphur Well, 7 miles north of Lexington, Fayette County.	.....	.....	.....	Saline, sulphureted.	.....
James Mineral Spring, near Springfield, Washington County.	.....	.....	.....	do	.....
Jesse's Mineral Well, near Versailles, Woodford County.	.....	.....	.....	Sulphureted	.....
Kentucky Alum Springs, Boyle County, 92 miles from Louisville.	8	.....	.....	.....	Used commercially.
Kirk Spring, Lewis County.	.....	.....	.....	.....	.....
Kuttawa Mineral Springs, near Kuttawa, Lyon County.	4	1,200	62	Alkaline, carbonated.	Has local reputation.
Latonia Springs, 4 miles from Covington, Kenton County.	5	.....	.....	Sulphureted, saline.	Resort.
Lexington Mineral Well, Lunatic Asylum, Lexington, Fayette Co.	.....	.....	.....	Saline, sulphureted.	.....
Linsey's Mineral Spring, Christian Co.	.....	.....	71	Sulphureted	.....
Louisville (Dupont's) Artesian Well, Louisville, Jefferson County.	1	.....	.....	Saline	.....
Mammoth Well, Nelson County.	.....	.....	.....	.....	.....
Milldale Mineral Well, Milldale, Kenton County.	.....	.....	.....	Saline, sulphureted.	.....
Miller's Mineral Well, near Barboursville, Knox County.	.....	.....	.....	Saline	.....
<i>Mineral springs:</i>					
At Slick Rock, Barren County...	.....	.....	.....	.....	.....
In Menifee County	.....	.....	.....	.....	.....
In Martin County	.....	.....	.....	.....	.....

*Mineral springs of Kentucky — Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Mineral springs — Continued.</i>			°		
At railroad crossing, Green River, Lincoln County.	.....	.....	.....	Saline, sulphureted.	Resort.
In Lee County .....	.....	.....	.....	.....	.....
In Marshall County .....	.....	.....	.....	.....	.....
On Kettle Creek, Cumberland Co.	.....	.....	.....	.....	.....
In Robertson County .....	.....	.....	.....	.....	.....
At Allen Springs, Warren County	.....	.....	.....	.....	.....
In Floyd County .....	.....	.....	.....	Weak Saline	.....
At Harmony, Owen County .....	.....	.....	.....	.....	.....
In Henderson County .....	.....	.....	.....	.....	.....
At copper mine, near Irvine, Estill County.	.....	.....	.....	Saline	.....
In La Rue County .....	.....	.....	.....	.....	.....
Near New Concord, Calloway Co.	.....	.....	.....	.....	.....
In Carter County .....	.....	.....	.....	.....	.....
In Clay County .....	.....	.....	.....	.....	.....
In Pendleton County .....	.....	.....	.....	.....	.....
In Powell County .....	.....	.....	.....	.....	.....
Two miles from Downingsville, Grant County.	.....	.....	.....	.....	.....
<i>Mineral wells:</i>					
At Walnut Hill, Fayette County.	.....	.....	.....	Saline, sulphureted.	.....
At Paint Lick, Garrard County ..	.....	.....	.....	Saline	.....
Near Crab Orchard, Lincoln Co.	.....	.....	.....	Sulphureted	.....
At Smith's Grove, Warren Co	.....	.....	.....	Saline, sulphureted.	.....
At Dr. J. Read's, Madison County.	.....	.....	.....	Sulphureted	.....
Two miles west of Nicholasville, Jessamine County.	.....	.....	.....	Saline, sulphureted.	.....
Mixed Spring, $\frac{1}{2}$ mile from Dripping Springs, Lincoln County.	1	200	56	Saline, chalybeate.	Do.
Murray's Springs, near Lewis, Daviess County.	.....	.....	.....	do	.....
Nevien's Sulphur Springs, sources of Salt River, Lincoln County.	.....	.....	.....	Saline, sulphureted.	.....
Oliver Springs, Daviess County .....	.....	.....	.....	.....	.....
Olympian Springs, Olympia, Bath Co.	10 +	.....	54 to 62	Saline, sulphureted.	.....
Paroquet Springs, near Shepherdsville, Bullitt County.	.....	.....	.....	do	Do.
Pollard's Mineral Well, near Crab Orchard, Lincoln County.	1	.....	.....	Sulphureted	.....
Robb's Chalybeate Spring, on Massack Creek, McCracken County.	1	.....	.....	Chalybeate	.....
Rockcastle Spring, Rockcastle Springs, Pulaski County.	1	25	.....	do	Do.
Rochester Springs, Boyle County, 17 miles from Harrodsburg.	.....	.....	.....	Saline	.....
Rough Creek Springs, Grayson Co.	.....	.....	.....	.....	.....
Russell Sulphur Springs, Russell Co.	2	.....	.....	.....	.....
Salt Sulphur, Bath County .....	.....	.....	.....	.....	.....
Salt Sulphur Well, Nicholasville, Jessamine County.	.....	.....	.....	Saline, sulphureted.	.....
Salubrian Springs, 8 miles southeast of Hopkinsville, Christian County.	2	60	50	Sulphureted	Local resort.
Sebree Springs, near Sebree, Webster County.	2 +	.....	.....	Saline, sulphureted, and chalybeate.	Resort.
Social Hill Mineral Spring, at Judge Eaves's, Muhlenberg County.	.....	.....	.....	Sulphureted	.....
Sowder's Spring, near Crab Orchard, Lincoln County.	.....	.....	.....	.....	.....
St. Bernard Springs, $\frac{1}{2}$ mile northwest of Morton's Gap, Hopkins County.	.....	.....	.....	.....	.....
Sudduth or Mud Spring, Mud Lick, Bath County.	.....	.....	.....	.....	.....
<i>Sulphur springs:</i>					
At Sinking Spring, 7 miles from Big Spring, Breckinridge Co.	.....	.....	.....	.....	.....
In Hancock County .....	.....	.....	.....	.....	.....
One mile east of Clear Spring, Graves County.	.....	.....	.....	.....	.....

*Mineral springs of Kentucky—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Sulphur springs—Continued.</i>			°		
In Union County .....					Resort.
In Jackson County .....					
In Johnson County .....					
In Breathitt County .....					
In Livingston County .....			59	Saline, chalybeate.	
On Doe Run, southeast of Brandenburg, Meade County.					
Southeast of Morganfield, Union County.					
Southwest of Jeffersonville, Montgomery County.					
Sulphur Mineral Well, Fleetwood farm, near Frankfort, Franklin Co.				Saline, sulphureted.	
Swinney's Chalybeate Spring, 1½ miles from Chameleon Springs, Edmonson County.				Chalybeate	
Taliaferro Springs, 1½ miles southwest of Morton's Gap, Hopkins Co.				Saline	
Tar Springs, south of Cloverport, Breckinridge County.					
Trice's Salt Sulphur Well, Hopkinsville, Christian County.					
Washington Bell's Sulphur Spring, on Sulphur Lick Creek, Nelson Co.	1				Do.
White Sulphur Mineral Spring, Marion County.					
<i>White sulphur springs:</i>					
At Cloverport, Breckinridge Co.				Saline, sulphureted.	
In Ohio County.					Do.
White Sulphur Well, Sulphur Well, Metcalfe County.					
Williams's Mineral Well, near Versailles, Woodford County.	1			Saline	
Wilson's Saline-Chalybeate Spring, Lexington, Fayette County.				Alkaline	
Yates Mineral Spring, near base of Knob Lick, Boyle County.				Saline	
Yelvington Spring, Yelvington, Daviess County.					
Young's Springs, Young's Springs, Bath County.	3	58	57 to 62	Sulphureted	Do.

*Analyses of mineral springs in Kentucky.*

Constituents.	Bryant's Springs.					
	Chalybeate Fountain.	Knob Spring.	Pasture Spring.	Stone's Sulphur Spring.	Valley Spring.	Well.
<i>Solids.</i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>
Calcium carbonate .....	0.12		0.09	0.06	0.09	0.48
Magnesium carbonate .....	0.02		0.04	0.12	0.05	0.01
Iron carbonate .....	0.01	Trace	0.02	0.02	Trace	0.02
Sodium sulphate .....		0.21				0.02
Potassium sulphate .....	0.01	0.02	0.03	0.01	0.02	0.07
Calcium sulphate .....		0.10	0.01	0.01	Trace	0.97
Magnesium sulphate .....	0.03	0.07	0.07	0.02	0.01	0.90
Sodium chloride .....	0.09	0.93	0.02	Trace	0.18	0.28
Magnesium chloride .....					0.04	
Silica .....	0.01	0.01	0.04	0.03	0.01	0.09
Total .....	0.29	1.34	0.32	0.27	0.40	2.84

<sup>a</sup> Robert Peter, analyst.

## Analyses of mineral springs in Kentucky—Continued.

Constituents.	Crab Orchard Springs.		Blue Lick Spring (Upper).	Chalybeate Springs near Cumberland Falls.	
	Field Spring.	Grove Spring.		North Side River.	South Side River.
<i>Solids.</i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>
Calcium carbonate.....	0.14	0.19	25.06	0.05	0.04
Magnesium carbonate.....	0.13	0.04	0.14	0.03	0.03
Manganese carbonate.....	} 0.01 {	0.01	.....	} 0.01	0.01
Iron carbonate.....		0.02	.....		
Sodium sulphate.....	0.02	.....	.....	.....	.....
Potassium sulphate.....	0.02	0.01	12.97	.....	.....
Calcium sulphate.....	.....	.....	44.13	0.01	Trace
Magnesium sulphate.....	0.07	0.06	.....	0.01	0.01
Iron sulphate.....	.....	.....	.....	Trace	0.01
Calcium phosphate.....	.....	.....	41.97	.....	.....
Sodium chloride.....	0.01	0.01	516.54	Trace	Trace
Potassium chloride.....	.....	.....	1.80	Trace	Trace
Magnesium chloride.....	.....	.....	37.72	.....	.....
Magnesium bromide.....	.....	.....	3.80	.....	.....
Magnesium iodide.....	.....	.....	0.16	.....	.....
Silica.....	0.04	0.04	1.00	0.03	0.01
Nitric acid.....	.....	Trace	.....	.....	.....
Loss.....	.....	.....	14.88	0.04	0.01
Total.....	0.44	0.38	660.17	0.18	0.12
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Sulphureted hydrogen.....	.....	.....	10.24	.....	.....
Carbonic acid.....	.....	.....	60.11	.....	.....

  

Constituents.	Estill Springs.				
	Red Sulphur Spring, near saloon.	White Sulphur Spring.	Red Sulphur Spring.	Black Sulphur Spring.	Chalybeate Spring.
<i>Solids.</i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>
Sodium carbonate.....	0.02	0.08	.....	0.11	0.16
Calcium carbonate.....	0.20	0.30	0.02	0.03	0.05
Magnesium carbonate.....	0.08	0.01	0.02	0.07	0.03
Iron carbonate.....	.....	.....	Trace	0.03	0.01
Sodium sulphate.....	0.17	0.04	.....	0.02	0.01
Potassium sulphate.....	0.09	0.07	0.01	0.02	0.01
Calcium sulphate.....	.....	.....	.....	.....	0.28
Magnesium sulphate.....	0.01	0.11	0.04	0.02	0.17
Aluminium sulphate.....	.....	.....	.....	0.02	.....
Sodium chloride.....	0.09	0.01	0.10	0.04	0.01
Calcium chloride.....	.....	.....	0.11	.....	.....
Alumina.....	.....	0.02	.....	.....	Trace
Silica.....	0.01	Trace	0.03	0.01	0.03
Organic matter.....	0.04	0.05	0.04	0.06	0.14
Total.....	0.71	0.69	0.37	0.41	0.89
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Sulphureted hydrogen.....	0.0045	0.003	0.012	0.035	.....
Carbonic acid.....	0.3256	0.360	0.228	0.263	0.269

<sup>a</sup> Robert Peter, analyst.<sup>b</sup> J. F. Judge and A. Fennel, analysts (1870).<sup>c</sup> With aluminium sulphate.<sup>d</sup> With alumina and peroxide of iron.<sup>e</sup> With trace of phosphates.

*Analyses of mineral springs in Kentucky—Continued.*

Constituents.	Epsom Spring, near Crab Orchard.	Foley's Epsom Spring.	Sebree Springs.		
			Sulphur Spring.	Chalybeate Spring.	Korb Spring.
<i>Solids.</i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>b</sup></i>	<i>Grains in 1,000.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Calcium carbonate .....	0.67	0.91	0.218	0.025	1.21
Magnesium carbonate .....	0.12	0.13	0.050	0.018	12.45
Manganese carbonate .....				Trace	
Iron carbonate .....	Trace	Trace		0.050	2.77
Sodium sulphate .....	0.77	1.01	0.143	0.020	
Potassium sulphate .....	0.07	0.17	0.004	0.004	
Calcium sulphate .....	0.20	0.19	0.062	0.022	11.72
Magnesium sulphate .....	3.45	3.52	0.057		
Sodium chloride .....	0.08	0.30	0.276	0.003	2.80
Iron oxide .....					4.38
Silica .....	0.06	0.06	0.017	0.001	
Organic matter .....			0.008	0.006	
Loss .....		0.59			
	5.42	6.88	0.835	0.129	33.33

Constituents.	Blue Lick Spring (Lower).		Brown Spring.	Grayson Springs.
				Center Spring.
<i>Solids.</i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>
Sodium carbonate .....		0.0140		
Calcium carbonate .....	0.3850	0.3184	0.12	0.17
Magnesium carbonate .....	0.0022	0.0211	0.02	Trace
Manganese carbonate .....			Trace	
Iron carbonate .....	<sup>d</sup> 0.0058	<sup>d</sup> 0.0038	0.03	} Trace
Potassium sulphate .....	0.1519		0.03	
Calcium sulphate .....	0.5533	0.5508	0.02	1.17
Magnesium sulphate .....			0.11	0.58
Aluminium sulphate .....				<sup>c</sup> Trace
Strontium sulphate .....		0.0011		
Barium sulphate .....		0.0002		
Manganese sulphate .....				} <sup>d</sup> Trace
Iron sulphate .....				
Sodium borate .....		0.0298		
Sodium chloride .....	8.3473	8.3571	0.02	
Calcium chloride .....		0.0606		
Potassium chloride .....	0.0227	0.1860		
Lithium chloride .....		0.0060		
Magnesium chloride .....	0.5272	0.4864		0.19
Magnesium bromide .....	0.0039	0.0195		
Magnesium iodide .....	0.0007	0.0003		
Sodium sulphide .....		0.0307		0.06
Potash .....				Trace
Soda .....				Trace
Silica .....	0.0179	0.0149	0.04	Trace
Lithium .....				
Iodine .....				} Traces
Bromine .....				
Organic matter .....	} 0.2821	0.4573	0.05	Trace
Loss .....				
Total .....	10.3000	10.5580	0.44	2.17
<i>Gases.</i>				
Sulphureted hydrogen .....	0.3947	Undeterm'd		0.0200
Carbonic acid .....	0.3547	do		0.1950

<sup>a</sup> Robert Peter, analyst (1850).<sup>b</sup> A. M. Peter, analyst (1877).<sup>c</sup> E. S. Wayne, analyst (1884).<sup>d</sup> With alumina and calcium phosphates.<sup>e</sup> With phosphates.

*Analyses of mineral springs in Kentucky—Continued.*

Constituents.	Grayson Springs.				
	McAtee Spring.	Moreman Spring.	Jar Spring.	Eye Spring.	Stump Spring.
<i>Solids.</i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>
Calcium carbonate .....	0.18	0.20	0.16	0.19	0.20
Magnesium carbonate .....	Trace	0.05	0.03	Trace	Trace
Manganese carbonate .....	}	0.01	0.01	0.01	0.01
Iron carbonate .....					
Sodium sulphate .....	0.02	.....	.....	0.02	0.04
Potassium sulphate .....	Trace	.....	Trace	Trace	Trace
Calcium sulphate .....	0.45	0.45	0.51	0.67	0.63
Magnesium sulphate .....	0.46	0.38	0.58	0.75	0.61
Manganese sulphate .....	}	<sup>b</sup> Trace	<sup>b</sup> Trace	<sup>b</sup> Trace	.....
Iron sulphate .....					
Sodium chloride .....	0.02	.....	0.08	0.11	Trace
Magnesium chloride .....	.....	0.02	.....	.....	Trace
Sodium sulphide .....	.....	0.04	0.02	0.01	.....
Potash .....	.....	Trace	.....	.....	.....
Soda .....	.....	0.01	.....	.....	.....
Silica .....	Trace	Trace	Trace	0.01	Trace
Lithium .....	}	Traces	}	.....	.....
Iodine .....					
Bromine .....					
Organic matter .....	Trace	.....	0.23	0.03	0.02
Total .....	1.16	1.16	1.62	1.80	1.51
<i>Gases.</i>	.....	.....	.....	.....	.....
Sulphureted hydrogen .....	0.0203	0.0248	0.0265	0.0239	0.0410
Carbonic acid .....	0.1500	0.1234	0.2020	.....	0.1650

Constituents.	Grayson Springs.					
	White Sulphur.	Hymeneal Spring.	Rock Spring.	Artesian Well.	Chalybeate well at Springs.	Chalybeate well near Springs.
<i>Solids.</i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>
Calcium carbonate .....	0.18	0.15	0.17	0.14	0.12	0.26
Magnesium carbonate .....	Trace	( <sup>c</sup> )	0.01	0.02	Trace	Trace
Manganese carbonate .....	}	0.01	}	0.01	0.01	0.08
Iron carbonate .....						
Sodium sulphate .....	.....	0.03	.....	.....	Trace	1.13
Potassium sulphate .....	.....	0.01	Trace	.....	Trace	0.06
Calcium sulphate .....	0.65	0.90	0.59	1.30	0.01	2.33
Magnesium sulphate .....	0.65	0.88	0.47	0.88	Trace	0.74
Manganese sulphate .....	}	<sup>b</sup> Traces	<sup>d</sup> Traces	Traces	.....	.....
Iron sulphate .....						
Sodium chloride .....	0.02	0.02	0.01	0.30	0.01	0.15
Potassium chloride .....	.....	.....	.....	.....	0.01	.....
Sodium sulphide .....	0.02	0.02	Trace	0.03	.....	.....
Silica .....	0.03	.....	0.01	0.03	Trace	0.03
Organic matter .....	0.18	.....	0.15	Trace	.....	.....
Total .....	1.74	1.99	1.45	2.71	0.16	4.78
<i>Gas.</i>	.....	.....	.....	.....	.....	.....
Sulphureted hydrogen .....	0.0270	.....	.....	0.0330	.....	.....

<sup>a</sup> Robert Peter. <sup>b</sup> With phosphates. <sup>c</sup> Not estimated. <sup>d</sup> With alumina, sulphate, and phosphates.

*Analyses of mineral springs in Kentucky—Continued.*

Constituents.	Harrodsburg Springs.		Howard's Sulphur Well.	Kentucky Alum Springs.	Elliston's Sulphur Spring.	Indian Spring.
	Saloon Spring.	Grenville Spring.				
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains in 1,000.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Parts in 1,000.<sup>b</sup></i>	<i>Grains in 1,000.<sup>b</sup></i>
Sodium carbonate					0.10	
Calcium carbonate	23.92	4.80	0.01		0.20	0.01
Magnesium carbonate	2.08	22.96	0.07		0.03	Trace
Manganese carbonate						
Iron carbonate	2.88				<sup>d</sup> 0.02	<sup>e</sup> 0.01
Sodium sulphate						Trace
Potassium sulphate			0.01	Trace		Trace
Calcium sulphate	81.92	88.48		4.76	0.43	0.07
Magnesium sulphate	223.36	129.28	0.01	0.97		Trace
Aluminium sulphate				40.26		
Ammonium sulphate				Trace		
Manganese sulphate				Trace		
Iron sulphate				1.71		
Iron persulphate				14.39		
Sodium chloride	9.92	Trace	0.02	0.53	0.32	0.04
Calcium chloride					0.01	
Potassium chloride					0.04	Trace
Magnesium chloride					0.09	
Sodium sulphide					Trace	
Alumina			Trace			
Silica			0.02	3.50	0.01	0.01
Strontium					Trace	
Lithium					Trace	
Organic matter					0.33	
Phosphoric acid				Trace		
Loss			0.02			
Total	349.08	245.52	0.16	66.12	1.58	0.14

Constituents.	Hickman's Springs.					
	No. 1. Alum Spring.	No. 2. Alum Spring.	No. 3. Sulphur Spring.	No. 4. Brick Spring.	No. 5. Yellow Spring.	No. 6. Sweet Spring.
<i>Solids.</i>	<i>Grains in 1,000.<sup>b</sup></i>	<i>Grains in 1,000.<sup>b</sup></i>	<i>Grains in 1,000.<sup>b</sup></i>	<i>Grains in 1,000.<sup>b</sup></i>	<i>Grains in 1,000.<sup>b</sup></i>	<i>Grains in 1,000.<sup>b</sup></i>
Calcium carbonate			0.11	0.12	0.03	
Magnesium carbonate			0.02	0.03	0.02	
Sodium sulphate	0.07	0.30	0.46	0.50	0.21	
Potassium sulphate	Trace	0.01	Trace	0.01	0.01	0.01
Calcium sulphate	0.60	0.39	0.13	0.08	0.14	0.33
Magnesium sulphate	0.33	0.33	0.16	0.11	0.07	0.25
Aluminium sulphate	1.25	0.33				0.35
Manganese sulphate	Trace	0.01				0.07
Iron persulphate	0.88	0.05				0.15
Copper sulphate	Trace				Trace	
Sodium chloride	Trace	0.01	0.08	0.02	0.01	0.06
Iron oxide			<sup>f</sup> Trace	<sup>f</sup> Trace	<sup>f</sup> Trace	
Silica	Trace	Trace	0.02	0.03	0.03	Trace
Lithium	Trace	Trace	Trace	Trace	Trace	Trace
Organic matter		0.03	0.04		0.03	0.19
Total	3.13	1.46	1.02	0.90	0.55	1.41

<sup>a</sup> Raymond, analyst.<sup>b</sup> Robert Peter, analyst.<sup>c</sup> Dr. L. D. Kastenbine, analyst.<sup>d</sup> With phosphoric acid.<sup>e</sup> With phosphates and alumina.<sup>f</sup> With manganese oxide.

*Analyses of mineral springs in Kentucky—Continued.*

Constituents.	Louisville Artesian Well.	Milldale Mineral Well.	Mineral Well, Smith's Grove.	Sulphur Well near Frankfort.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains in 1,000.<sup>c</sup></i>	<i>Grains in 1,000.<sup>c</sup></i>
Sodium carbonate .....			0.04	0.04
Sodium bicarbonate .....	2.73			
Calcium carbonate .....			0.15	0.25
Calcium bicarbonate .....	5.99			
Magnesium carbonate .....		1.20	0.02	Trace
Magnesium bicarbonate .....	2.76			
Strontium carbonate .....			Trace	
Iron bicarbonate .....	0.35			
Sodium sulphate .....	72.30		0.02	
Potassium sulphate .....	3.22		Trace	
Calcium sulphate .....	29.43	1.22	0.10	0.11
Magnesium sulphate .....	77.34		0.29	
Aluminium sulphate .....	1.80			
Sodium phosphate .....	1.54			
Sodium chloride .....	621.53	509.26	0.05	0.05
Calcium chloride .....	65.73	11.26		0.03
Potassium chloride .....	4.22	0.62		0.01
Lithium chloride .....	0.10		Not estimated	
Magnesium chloride .....	14.78	8.42		0.02
Aluminium chloride .....	1.21			
Magnesium bromide .....	0.47			
Magnesium iodide .....	0.35			
Silica .....	0.89		Trace	Trace
Organic matter .....	0.71			
Phosphoric acid .....				Trace
Nitric acid .....				Trace
Loss .....	8.12		0.25	
Total .....	915.57	531.98	0.92	0.51
<i>Gases.</i>		<i>Cubic inches.</i>		
Sulphureted hydrogen .....	2.01	0.78		
Carbonic acid .....	6.17			
Nitrogen .....	1.36			

Constituents.	Murray's Springs.	Paroquet Springs.	Pollard's Mineral Well.	Mineral Spring near Irvine.
<i>Solids.</i>	<i>Grains in 1,000.<sup>c</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains in 1,000.<sup>d</sup></i>	<i>Grains in 1,000.<sup>c</sup></i>
Sodium carbonate .....		0.38	0.02	
Calcium carbonate .....	0.12	2.40	0.14	0.53
Magnesium carbonate .....	0.01	1.50	0.15	0.04
Manganese carbonate .....				0.02
Iron carbonate .....	0.02	0.18		
Sodium sulphate .....	0.05	2.41		
Potassium sulphate .....	0.04		0.07	0.04
Calcium sulphate .....	0.02	2.28	Trace	0.55
Magnesium sulphate .....	0.08			4.52
Aluminium sulphate .....		0.49		
Sodium chloride .....	0.01	309.60	0.69	0.30
Calcium chloride .....		67.71		0.03
Potassium chloride .....		0.48	0.02	
Lithium chloride .....	Trace			
Magnesium chloride .....		48.03	0.12	
Magnesium bromide .....		0.31		
Sodium bromide .....		0.18		
Sodium iodide .....		0.16		
Magnesium iodide .....		0.25		
Alumina .....	Trace			
Silica .....	0.02	3.90	0.01	0.07
Organic matter .....		2.14		
Phosphoric acid .....	Trace			
Loss .....				1.47
Total .....	0.37	442.40	1.22	7.57
<i>Gases.</i>		<i>Cubic inches.</i>		
Sulphureted hydrogen .....		0.30		
Carbonic acid .....		0.06		

<sup>a</sup> J. Lawrence Smith, analyst.<sup>b</sup> E. S. Wayne, analyst.<sup>c</sup> Robert Peter, analyst.<sup>d</sup> Robert Peter, analyst (1861).

*Analyses of mineral springs in Kentucky—Continued.*

Constituents.	Olympian Springs.			
	Salt Sulphur Spring.		Black Sulphur Spring.	
<i>Solids.</i>	<i>Parts in 1,000.<sup>a</sup></i>	<i>Parts in 1,000.<sup>b</sup></i>	<i>Parts in 1,000.<sup>a</sup></i>	<i>Parts in 1,000.<sup>b</sup></i>
Sodium carbonate.....	( <sup>c</sup> )	( <sup>c</sup> )	0.254	0.3247
Calcium carbonate.....	0.230	0.1975	0.114	0.0158
Magnesium carbonate.....	0.124	0.0506	0.006	0.0046
Strontium carbonate.....		0.0045		
Manganese carbonate.....		<sup>d</sup> Trace		<sup>d</sup> Trace
Iron carbonate.....	Trace	0.0025	Trace	0.0024
Barium carbonate.....		0.0128		
Sodium sulphate.....				0.0025
Potassium sulphate.....			0.002	0.0031
Calcium sulphate.....	Trace	0.0083		0.0061
Magnesium sulphate.....			0.012	
Sodium chloride.....	2.847	4.8997	0.127	0.1218
Calcium chloride.....		0.0213		
Potassium chloride.....	0.183	0.0355		
Lithium chloride.....		0.0008		Trace
Magnesium chloride.....	0.950	0.1689		
Sodium bromide.....		0.0166		
Sodium iodide.....		Trace		Trace
Sodium sulphide.....		Trace		Trace
Alumina.....	Trace	0.0006		
Silica.....	0.018	0.0232	0.043	0.0124
Iodine.....	Trace			
Bromine.....	Trace			
Boric acid.....		Trace		Trace
Phosphoric acid.....		Trace		Trace
Loss and organic matter.....	1.348	0.0340		0.0164
Total.....	54.708	5.4168	0.558	0.5098
<i>Gases.</i>				
Sulphureted hydrogen.....	Present	0.0011	Present	0.0012
Carbonic acid.....	0.318	0.2400		0.2781

Constituents.	Olympian Springs.			
	White Sulphur Spring.	Main Chalybeate Spring.	Main Chalybeate Spring.	Chalybeate Spring.
<i>Solids.</i>	<i>Parts in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>b</sup></i>	<i>Grains in 1,000.<sup>a</sup></i>	<i>Grains in 1,000.<sup>c</sup></i>
Sodium carbonate.....	0.3113			0.0890
Calcium carbonate.....	0.0744	0.0998	0.101	0.0103
Magnesium carbonate.....	0.0316	0.0143	0.022	
Manganese carbonate.....		Trace		Trace
Iron carbonate.....		0.0242	( <sup>c</sup> )	0.0100
Sodium sulphate.....	0.0408			0.0238
Potassium sulphate.....	0.0133	0.0125	0.070	0.0117
Calcium sulphate.....	0.0039	0.0554	0.020	0.0366
Magnesium sulphate.....		0.1170	0.021	0.0693
Sodium chloride.....	0.1326	0.0308	0.035	0.0060
Lithium chloride.....	Trace	Trace		Trace
Magnesium chloride.....	0.0071	0.0031		
Sodium bromide.....	Trace			
Sodium iodide.....	Trace			
Sodium sulphide.....	Trace			
Alumina.....	0.0021			
Silica.....	0.0115	0.0332	0.107	0.0198
Apocrenic acid.....		Trace		Trace
Boric acid.....	Trace			Trace
Phosphoric acid.....	Trace	Trace		0.0168
Loss.....		0.0194		
Total.....	0.6286	0.4097	0.376	0.2933
<i>Gases.</i>				
Hydrogen sulphide.....	( <sup>c</sup> )			
Carbonic acid.....	( <sup>c</sup> )	0.1214	Present	0.1260

<sup>a</sup> Robert Peter, analyst (1861).<sup>b</sup> Robert Peter, analyst (1880).<sup>c</sup> Not estimated.<sup>d</sup> With phosphoric acid.<sup>e</sup> Robert Peter, analyst.<sup>f</sup> With iron and manganese carbonates.

*Analyses of mineral springs in Kentucky—Continued.*

Constituents.	Olympian Springs.				
	Salt Lick.	Epsom Well.	Tea Spring.	Kitchen Well.	
	<i>Pts. in 1,000.<sup>a</sup></i>	<i>Pts. in 1,000.<sup>a</sup></i>	<i>Grs. in 1,000.<sup>b</sup></i>	<i>Pts. in 1,000.<sup>c</sup></i>	<i>Pts. in 1,000.<sup>d</sup></i>
Sodium carbonate .....	0.23		0.45	0.54	Trace
Calcium carbonate .....	0.18	0.65	0.02	0.05	0.19
Magnesium carbonate .....	0.05	0.22	0.01	0.03	0.10
Strontium carbonate .....	Trace		Trace	Trace	
Manganese carbonate .....	*Trace		Trace	} 0.01 {	
Iron carbonate .....	*Trace	Trace	Trace		Trace
Barium carbonate .....	0.01				
Sodium sulphate .....		1.36		0.02	
Potassium sulphate .....		0.04		0.03	0.27
Calcium sulphate .....	Trace	0.58		0.01	0.01
Magnesium sulphate .....		2.60			
Strontium sulphate .....			Trace		
Iron sulphate .....		Trace			
Sodium chloride .....	4.71	0.83	0.04	0.15	4.25
Calcium chloride .....	0.02				
Potassium chloride .....	0.04		Trace		0.06
Lithium chloride .....	Trace				
Magnesium chloride .....	0.12			Trace	0.55
Sodium sulphide .....				Trace	
Alumina .....		Trace			
Silica .....	0.02	0.02	0.03	0.03	0.04
Bromine .....	Trace				
Boric acid .....	Trace		*Trace	Trace	
Loss .....	0.01				
Total .....	5.39	6.28	0.55	0.87	5.47

Constituents.	Rockcastle Chalybeate Spring.	Sowder's Spring.	Trice's Salt- Sulphur Well.	Mineral Well, Walnut Hill.	Williams's Mineral Well.
	<i>Pts. in 1,000.<sup>a</sup></i>	<i>Grs. in 1,000.<sup>a</sup></i>	<i>Pts. in 1,000.<sup>a</sup></i>	<i>Grs. in 1,000.<sup>a</sup></i>	<i>Grs. in 1,000.<sup>a</sup></i>
Sodium carbonate .....			0.24	Trace	
Calcium carbonate .....	0.0438	0.51	0.12	0.13	Trace
Magnesium carbonate .....	0.0148	0.38	0.03	0.04	Trace
Manganese carbonate .....			Trace		
Iron carbonate .....	0.0145	Trace	Trace	Trace	
Sodium sulphate .....	0.0531	0.40	0.53		
Potassium sulphate .....		0.30			
Calcium sulphate .....	0.0029	1.57	0.12	0.34	
Magnesium sulphate .....	0.0036	2.99	0.43		
Sodium chloride .....	0.0026	1.00	3.36	4.01	2.34
Calcium chloride .....				0.01	0.32
Potassium chloride .....			Trace	0.08	0.01
Magnesium chloride .....				0.32	0.28
Magnesium iodide .....			Trace		
Sodium sulphide .....			( <sup>e</sup> )		
Alumina .....			Trace		
Silica .....	0.0128		0.01	0.02	<sup>b</sup> 0.60
Iodine .....				Trace	
Bromine .....			Trace	Trace	
Boric acid .....			Trace		
Total .....	0.1481	7.15	4.84	4.95	3.55

<sup>a</sup> Robert Peter, analyst.<sup>b</sup> Robert Peter, analyst (1877).<sup>c</sup> Robert Peter, analyst (1880).<sup>d</sup> Robert Peter, analyst (1861).<sup>e</sup> With phosphates.<sup>f</sup> With loss.<sup>g</sup> Not estimated.<sup>h</sup> With sulphuric acid, bromine, alumina, loss.

*Analyses of mineral springs in Kentucky—Continued.*

Constituents.	Mineral Well, Paint Lick.	Burgher's Spring, or Fountain of Life.	Clear Creek Sulphur Springs.	Davis Mineral Well.	Kuttawa Mineral Springs.	Wilson's Saline-Chalybeate Spring.
<i>Solids.</i>		<i>Parts in 1,000.<sup>a</sup></i>	<i>Parts in 1,000.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Parts in 1,000.<sup>c</sup></i>	<i>Grains per gallon.</i>
Sodium carbonate.....	0.28		0.03			
Calcium carbonate.....	0.03	0.35	0.04		0.16	0.93
Magnesium carbonate.....	Trace	} 0.04 {	Trace			14.63
Iron carbonate.....	Trace					2.52
Alkaline carbonates.....					1.19	
Sodium sulphate.....	0.03			0.94	0.20	
Potassium sulphate.....	0.07			1.76		
Calcium sulphate.....	0.03	1.19	0.01	71.23		1.84
Magnesium sulphate.....	0.02	0.94	0.02	43.47	0.39	1.69
Aluminium sulphate.....		Trace		83.10		
Lithium sulphate.....		Trace				
Iron sulphate.....		Trace		9.21		
Sodium sulphate.....					0.42	
Calcium phosphate.....	Trace					
Sodium chloride.....	0.46	0.09		6.31	0.45	5.30
Calcium chloride.....			Trace			33.49
Potassium chloride.....						2.30
Magnesium chloride.....						17.66
Magnesium bromide.....						0.79
Alumina.....					1.20	
Silica.....	0.04	0.01	0.01	0.74		1.48
Silicates.....					0.05	
Organic matter.....				0.36		
Total.....	0.96	2.92	0.11	217.18	4.06	82.63
<i>Gas.</i>						
Carbonic acid.....					3.09	Cub. inches. 33.04

<sup>a</sup> Robert Peter, analyst.<sup>b</sup> E. S. Wayne, analyst (1882).<sup>c</sup> J. P. Barnum, analyst.

## ARKANSAS.

Among mineral spring States Arkansas occupies a prominent place. The reputation of her famous Hot Springs, which have been more or less improved and utilized for medicinal purposes since the early part of the century, has attracted attention to the subject throughout the State and has led the people to appreciate the value of their springs.

Although a large proportion of the springs have been improved, very few appear to have been subjected to quantitative chemical analysis. Only five are given in the table. The list of springs is based mainly upon data obtained from Owens's geological reports of Arkansas, supplemented, as in the case of most of the other lists, by information derived directly from persons interested in the various springs. Of the springs whose general character is known, probably half are chalybeate and nearly that number are also sulphureted.

Only about five are utilized commercially at present.

*Mineral springs of Arkansas.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Alum Spring, 3 miles west of Camden, Ouachita County.	.....	.....	o	.....	.....
Armstrong Spring, 8 miles west of Searcy, White County.	.....	.....	.....	.....	.....
Baker's Spring, section 14, township 5 south, range 30 west, Howard Co.	1	.....	61	Saline, sulphureted.	Resort.
Black Sulphur Springs, Van Buren Co.	.....	.....	.....	.....	.....
Blanchard Springs, Blanchard Springs, Union County.	17	1,700	.....	Saline, &c	Do.
Blanco Springs, 12 miles northwest of Hot Springs, Garland County.	3	.....	.....	.....	.....
Blood Spring (Ryder's), Montgomery County, 50 miles west of Hot Springs.	1	2,000	65	Saline, chalybeate.	Do.
Blowing Springs, 6 miles southwest of Springfield, Conway County.	.....	.....	.....	Sulphureted ?	Unimproved.
Bog Springs, near Paracrafta, Sevier Co.	.....	.....	.....	.....	Do.
Britt's Springs, Union County	.....	.....	.....	.....	.....
Bull Dog Mineral Springs, Montgomery County.	.....	.....	.....	.....	.....
Bussey's Mineral Spring, near El Dorado, Union County.	.....	.....	.....	Saline, chalybeate.	.....
Butler's Mineral Spring, near Magnolia, Columbia County.	.....	.....	63	do	.....
Cantrell Springs, 9 miles from Pine Bluff, Jefferson County.	.....	.....	.....	.....	.....
<i>Chalybeate springs:</i>					
Near Benton, Saline County	.....	.....	.....	.....	Do.
Near Danville, Yell County	.....	.....	62	Saline, chalybeate.	.....
Near Benner's Mill, Franklin Co.	.....	.....	.....	.....	Do.
Near Huntsville, Madison County	.....	.....	.....	Saline, chalybeate.	.....
Near Malvern, Hot Spring County	.....	.....	.....	.....	.....
Near Rose Bud, White County	2	40	58	Chalybeate	Used locally.
At Peach Orchard Gap, White Co.	.....	.....	.....	.....	.....
At Springfield, Conway County	.....	.....	.....	Chalybeate and sulphureted.	.....
In Scott County	.....	.....	.....	.....	.....
In Van Buren County	.....	.....	.....	.....	.....
Near White Rock, Franklin County	.....	.....	.....	.....	Unimproved.
Five miles southeast of Harrisburg, Poinsett County.	.....	.....	.....	Chalybeate	Do.
Chalybeate Hill Springs, Scott (?) Co	.....	.....	.....	Saline, sulphureted.	.....
Cherokee Springs, Benton County	.....	.....	.....	.....	.....
Cluster Springs, 3 miles east of Hot Springs, Garland County.	15+	.....	.....	Chalybeate	Resort.
Crawford Sulphur Springs, near Sumpster, Bradley County.	.....	.....	.....	Alkaline, sulphureted.	.....
Crystal Mineral Springs, near Crystal Springs, Montgomery County.	.....	.....	70	Chalybeate and saline.	.....
Dardanelle Sulphur Springs, 11 miles west of Dardanelle, Yell County.	4	110	.....	Sulphureted, saline.	Local resort.
De Soto Mineral Springs, De Soto Springs, Searcy County.	.....	.....	.....	.....	.....
Dovepark Springs, Hot Spring County, near Dovepark.	12	2,160	.....	.....	Used commercially and as a resort.
Edmondson Springs, near Jordanbrook, Sevier County.	.....	.....	.....	.....	Unimproved.
Eldorado Springs, Benton County	.....	.....	.....	.....	.....
England's Mineral Well, near Harrisburg, Poinsett County.	.....	.....	.....	Alkaline, sulphureted.	Do.
Excelsior Springs, near Yellville, Marion County.	.....	25	.....	.....	Used locally.
Eureka Springs, Eureka Springs, Carroll County.	} 30	2,710	{ 58 to 60	Calcic	Used commercially and as a resort.
Elm Store Springs, Elm Store, Randolph County.	3	360	62	.....	
Fairchild's Potash Sulphur Springs, Potash Sulphur, Garland County.	} 42	1,675	{ 58 to 70	.....	Do.

*Mineral springs of Arkansas — Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Flood's Chalybeate Spring, 10 miles north of Crystal Springs, Montgomery County.	.....	9,000	.....	.....	.....
Gap Springs, Howard County.....	.....	.....	.....	Alkaline, sulphureted.	.....
Gillen's White Sulphur Spring, 3 miles east of Hot Springs, Garland Co.	1	.....	.....	Saline ?	.....
Gray's Mineral Spring, section 20, township 5 north, range 29 west, Scott County.	.....	.....	.....	Alkaline, sulphureted.	.....
Green's Chalybeate Springs, near Buckville, Montgomery County.	.....	.....	.....	.....	.....
Gum Springs, Gum Springs, Cleveland County.	1+	25	.....	Sulphureted	Local resort.
Hickory Creek Sulphur Spring, near Hickory Creek, Hempstead Co.	.....	.....	.....	do	Unimproved. ?
Hot Springs, Hot Springs, Garland Co.	71	20,100	{ 93 } to { 157 }	Thermal.....	Resort.
Hubbard's Mineral Spring, 3 miles north of Prairie D'Anne, Hempstead County (t).	.....	.....	.....	Saline, chalybeate.	.....
Hutchinson's Sulphur Springs, Montgomery County, near Big Fork.	.....	.....	.....	.....	.....
Iron Sulphur Spring, Iron Springs, Montgomery County.	.....	.....	.....	Alkaline, saline.	.....
Leay's Springs, 5 miles north of Warren, Bradley County.	.....	.....	.....	.....	.....
Lee's Springs, 10 miles from Pine Bluff, Jefferson County.	} 5	{ 175 } to { 300 }	43	.....	Do.
Lemon's Chalybeate Springs, Montgomery County.	.....	.....	.....	.....	.....
Mammoth Spring, Fulton County	1	.....	{ 57 } to { 60 }	Calcic	.....
Mattock's Spring, 8 miles west of Princeton, Dallas County.	1	.....	.....	Sulphureted, saline.	.....
Maybury Springs, Montgomery County, 17 miles west of Hot Springs.	50+	.....	64	Saline	Do.
<i>Mineral springs:</i>					
In section 16, township 12 south, range 10 west, Bradley County.	.....	.....	.....	.....	.....
At Clear Spring, Clark County	.....	.....	.....	Sulphureted, chalybeate.	Used locally.
At Crystal Springs, Montgomery Co	.....	.....	70	Sulphureted and chalybeate.	.....
At Forrest City, St. Francis County	.....	.....	.....	Chalybeate	Unimproved.
Five miles south of Harrisburg, Poinsett County.	.....	.....	.....	.....	.....
In and near Mineral Springs, Howard County.	} 4	560	{ 60 } to { 64 }	Sulphureted, chalybeate, &c.	Resort.
At Mineral Springs, Howard Co	.....	.....	.....	.....	.....
Thirteen miles from Van Buren, Crawford County.	.....	.....	.....	.....	.....
In Sharp County	.....	.....	.....	.....	Unimproved.
In section 9, township 5 north, range 18 west, Perry County.	.....	.....	.....	.....	Do.
In section 25, township 10 south, range 25 west, Hempstead Co.	.....	.....	.....	Saline	.....
Mitchell's Chalybeate Springs, Stone Quarry Creek, Hot Spring County.	.....	.....	.....	Alkaline, saline.	.....
Mountain Valley Springs, 12 miles northwest of Hot Springs, Garland County.	3	64	.....	Calcic	Used commercially and as a resort.
Mount Nebo Springs, 5½ miles from Dardanelle, Yell County.	} 5	190+	{ 50 } to { 54 }	Chalybeate	Resort.
National Springs, National, Logan Co.	.....	.....	.....	.....	.....
Newton Springs, section 26, township 3 north, range 12 west, Pulaski Co.	.....	.....	.....	Chalybeate	Do.

## Mineral springs of Arkansas—Continued.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Pennywits Sulphur Springs, Crawford County.	.....	.....	o	Sulphureted .....	Resort.
Perryville Salt Well, Perryville, Perry County.	.....	.....	.....	Saline .....	.....
Rabourn Sulphur Springs, Mount Ida, Montgomery County.	.....	.....	.....	Alkaline .....	Do.
Ravenden Springs, Ravenden Springs, Randolph County.	.....	.....	82	Carbonated, chalybeate.	Do.
Rice's Spring on Mud Creek, Randolph County.	.....	.....	.....	Saline, chalybeate.	.....
Royston's Chalybeate Springs, section 33, township 7 south, range 25 west, Pike County.	.....	.....	.....	.....	.....
Saratoga Springs, Saratoga, Howard County.	.....	.....	.....	.....	.....
Sawyer's Spring, 2½ miles east of Elm Springs, Washington County.	.....	.....	.....	.....	.....
Scoby's Springs, 5 or 6 miles north of Warren, Bradley County.	.....	.....	.....	.....	.....
Scott's White Sulphur Springs, near Black Springs, Montgomery County.	.....	.....	.....	.....	.....
Searcy Springs, Searcy, White County.	.....	.....	.....	Sulphureted, chalybeate, &c.	Do.
Shover's Spring, section 7, township 13 south, range 23 west, Hempstead Co.	1	120	63	Chalybeate .....	Do.
Siloam Springs, Siloam Springs, Benton County.	} 29	12, 800	{57 to 59}	.....	.....
State Salt Springs, section 30, township 11 north, range 28 west, Franklin County.	.....	.....	.....	.....	.....
Sugar Loaf Springs, Van Buren (?) Co.	.....	.....	.....	.....	.....
Sulphur and Chalybeate Springs, 1 mile from Hopeville, Calhoun Co.	5	.....	.....	.....	Used commercially prior to the war.
<i>Sulphur springs:</i>					
Three miles from Clarendon, Monroe County.	.....	.....	.....	.....	.....
Near Enders, Faulkner County	.....	.....	.....	.....	Resort.
Near Fayetteville, Washington Co.	.....	.....	.....	.....	.....
Near Dr. Kuykendall's, (?) Washington County.	2	.....	.....	Saline, chalybeate, and sulphureted.	.....
South of Malvern, Hot Spring Co.	.....	.....	.....	.....	.....
At Sulphur Springs, Benton Co.	.....	.....	.....	.....	.....
Four miles east of Witherspoon, Hot Spring County.	.....	.....	.....	.....	.....
In section 35, township 4 north, range 17 west, Perry County.	.....	.....	.....	.....	Unimproved.
Thomas Mineral Spring, Beaver Bend Creek, Calhoun County.	.....	.....	.....	.....	.....
Turkey Chalybeate Springs, near Crystal Springs, Montgomery County.	.....	.....	.....	.....	.....
Van Patten's Spring, 2 miles south of Walnut Grove, Cross County.	.....	.....	.....	Chalybeate .....	.....
Warm Springs (or Rice's Spring), Warm Springs, Randolph County.	60	500	60.2	Alkaline .....	Resort.
Whisenant Chalybeate Springs, Kate's Branch of Ouachita, Montgomery Co.	.....	.....	.....	Alkaline, chalybeate.	.....
White Sulphur Springs, 8 miles southwest of Pine Bluff, Jefferson Co.	6	480	57	Sulphureted .....	Do.
Witherspoon Mineral Springs, near Witherspoon, Hot Spring County.	.....	.....	.....	Saline .....	Unimproved.
Witt's Springs, Witt's Spring, Searcy County.	} 4	.....	{55 to 60}	.....	Do.
Wittsburg Mineral Spring, Wittsburg, Cross County.	.....	.....	.....	.....	Do.
Woolley Springs, Woolley, Union Co.	.....	.....	.....	.....	.....

*Analyses of mineral springs in Arkansas.*

Constituents.	Eureka Springs; Ba- sin Spring.	Hot Springs.	Mountain Valley Springs.	Ravenden Springs.	Warm Springs.
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>d</sup></i>
Sodium bicarbonate .....	0.15				
Magnesium carbonate .....		0.13		4.48	1.54
Magnesium bicarbonate .....	0.47		3.17		
Calcium carbonate .....		3.97		4.61	6.51
Calcium bicarbonate .....	4.43		12.66		
Lithium carbonate .....				1.26	0.27
Iron carbonate .....					0.78
Iron bicarbonate .....			2.17		
Sodium sulphate .....	0.09	0.38			
Potassium sulphate .....	0.13	0.23			
Calcium sulphate .....		0.11	2.54	Trace	0.81
Aluminium sulphate .....				2.36	
Sodium chloride .....	0.19	0.01		2.18	1.57
Potassium chloride .....					1.42
Magnesium chloride .....				2.98	
Calcium chloride .....				1.24	
Calcium silicate .....		0.46			
Chlorine .....					
Iodine .....		Trace	} 0.88 {	Trace	Trace
Bromine .....		Trace			
Iron sesquioxide .....		0.10			
Iron .....	} 0.08 {				
Alumina .....		0.45			0.49
Silica .....	0.31	1.87	0.38	0.82	1.09
Organic matter .....		0.70		1.86	} 1.84
Volatile matter .....					
Water .....		0.14			
Phosphoric acid .....			0.02		
Loss .....					1.79
Total .....	5.85	8.55	21.82	21.79	18.11
<i>Gases.</i>				<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbonic acid .....				2.14	161.50
Atmospheric air .....				1.33	21.10
Ammonia .....	0.21				
Total .....	0.21			3.47	182.60

<sup>a</sup> Potter and Riggs, analysts (1880).<sup>b</sup> E. Hills Larkin, analyst (1859).<sup>c</sup> Chauvenet and Blair, analysts.<sup>d</sup> Wright and Merrill, analysts.

## INDIAN TERRITORY.

The list of springs for Indian Territory is doubtless incomplete, as very considerable portions of the Territory are but little known, especially in the western and northwestern sections.

Although several places are mentioned on the list as resorts, they are as a rule unimproved and are used principally during the summer by persons who camp near them in order to use the waters for medicinal purposes.

*Mineral springs of Indian Territory.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Court-House Spring, Cherokee Nation...	.....	.....	o	Sulphureted .....	
Harkin's Sulphur Springs, 20 miles east of Doaksville, Choctaw Nation.	3	300+	40	Sulphureted, saline.?	Resort.
Kia-li-a-gee Springs, 15 miles east of Wetum-ka, Creek Nation.	2	.....	.....	.....	Has a reputation among the Indians.
<i>Oil springs:</i>					
On Oil Creek, South of Mill Creek, Chickasaw Nation.	.....	.....	.....	.....	
Eighteen miles northeast of Tahlequah, Cherokee Nation.	.....	.....	.....	Sulphureted, chalybeate, &c.	Resort in summer.
Six miles north of Claremore Station, Cherokee Nation.	.....	.....	.....	.....	
Seco Springs, 3 miles from McAlister, Choctaw Nation.	3	.....	.....	Sulphureted and chalybeate.	
<i>Sulphur springs:</i>					
Fifty miles south of Erin Springs, Chickasaw Nation.	.....	.....	.....	.....	Used in summer.
At Tulsa, Creek Nation	.....	.....	.....	.....	
Seven miles from Claremore Station, Cherokee Nation.	.....	.....	.....	.....	

## LOUISIANA.

Available data as to Louisiana mineral springs are meager and the list given here is presumably incomplete. It is mainly compiled from information contained in letters from various portions of the State.

No analyses are presented, but the springs are probably similar to those of Mississippi, as the geological formations of the two States are largely the same. Salt or brine springs prevail in certain portions of the State, being common in Natchitoches and Rapides.

None of the medicinal waters is used commercially and those springs utilized as resorts appear to be mainly of local importance.

Walton describes only the De Soto Springs and the White Sulphur Springs of Catahoula.

*Mineral springs of Louisiana.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Abita Spring, near Covington, Saint Tammany Parish.	1	400	70	Chalybeate, &c.	Resort.
Belle Cheney Springs, Calcasieu Parish .....	4	.....	.....	.....	Local resort.
Castor Sulphur Springs, Castor Sulphur Springs, Catahoula Parish.	2	.....	.....	Chalybeate ...	Resort.
Claiborne Springs, Claiborne Cottage, near Covington, Saint Tammany Parish.	3	60+	60	do .....	Local resort.
Denham's Springs, Hill's Springs, Livingston Parish.	.....	.....	.....	.....	.....
De Soto Mineral Springs, $3\frac{1}{4}$ miles from Grand Cane, De Soto Parish.	.....	.....	.....	.....	.....
Horseshoe Springs, near Covington, Saint Tammany Parish.	.....	.....	.....	.....	.....
Labatt's Springs, near Covington, Saint Tammany Parish.	.....	.....	.....	.....	Resort.
Long's Springs, near Minden, Webster Parish. ....	.....	.....	.....	.....	.....
Mineral Springs, 30 miles south of Castor Sulphur Springs, Catahoula Parish.	.....	.....	.....	.....	.....
Samaritan Springs, near Covington, Saint Tammany Parish.	.....	.....	.....	.....	.....
<i>Sulphur springs:</i>	.....	.....	.....	.....	.....
Near Covington, Saint Tammany Parish .....	5	.....	.....	Sulphureted, &c.	Unimproved.
In Calcasieu Parish. ....	.....	.....	.....	.....	.....
Welch Springs, 1 mile from White Sulphur Springs, Catahoula Parish.	4	.....	.....	Chalybeate ...	.....
White Sulphur Springs, White Sulphur Springs, Catahoula Parish.	.....	.....	.....	Sulphureted and chalybeate.	Resort.

## TEXAS.

Walton's Mineral Springs of the United States gives three localities for Texas and Pepper's list includes five. There are, however, about twenty localities that are places of resort and at least seven the waters of which are on sale. Besides there are a great many springs at present unimproved, but which have local reputations for the curative effects of their waters. Mineral springs exist in at least thirty counties of the State.

The list as given here is made up partly from various maps and handbooks of Texas, supplemented by data derived from correspondence with persons in the localities thus obtained. The majority of the springs are still unanalyzed, but sulphureted waters appear to be most numerous. The occurrence of free sulphuric acid in so many springs is notable. Lampasas Springs, Burdett's Sour Mineral Wells, the Sour Lake Springs, and Hynson's Iron Springs appear to be those most widely known.

*Mineral springs of Texas.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Alum Springs, near Paige, Bastrop Co.	.....	.....	o	.....	Unimproved and unimportant.
Barksdale Spring, 20 miles west of Junction City, Kimble County.	1	.....	.....	Chalybeate	Unimproved.
Bauguss Mineral Springs, near Viola, Cass County.	2	75	.....	.....	Local resort.
Bells Mineral Wells, Blossom Prairie, Lamar County.	4	.....	.....	Saline	Resort, and to some extent commercially.
Bernard Sulphur Springs, near Spanish Camp, Wharton County.	.....	.....	.....	Sulphureted	Was once used locally.
Burdett's Sour Mineral Wells, 7 miles north of Luling, Caldwell County.	1+	.....	.....	Saline	Resort, and used commercially.
Cardwell Mineral Spring, 8 miles north-west of Luling, Caldwell County.	.....	.....	.....	.....	.....
Carrizo Springs, Carrizo Springs, Dimmit County.	100	{ 5,000 to 7,000 }	69	Saline	Unimproved.
Cedar Springs, Cedar Mills, Grayson County.	5	.....	.....	Sulphureted and chalybeate.	Once used as a resort.
Chandler's Spring, Lampasas, Lampasas County.	.....	.....	.....	.....	.....
<i>Chalybeate springs:</i>					
In Leon County	.....	.....	.....	.....	.....
On Trinity River, Madison Co.	.....	.....	.....	.....	.....
At Sulphur Springs, Hopkins Co.	.....	.....	.....	.....	.....
In Morris County	.....	.....	.....	.....	.....
In Bowie County	.....	.....	.....	.....	.....
At Alford's Bluff, Trinity County	.....	.....	.....	.....	.....
In Bell County	.....	.....	.....	.....	.....
Four miles east of Winnsborough, Wood County.	1	200	50-60	Chalybeate	Resort.
Coleman Springs, 6 miles southeast of Annona, Red River County.	3	.....	.....	Chalybeate and sulphureted.	Used to some extent as a resort.
Crabtree's Sour Wells, Sulphur Springs, Hopkins County.	2	.....	.....	Acid, chalybeate.	Resort and water sold.
Dalby Springs, Dalby Springs, Bowie County.	2	1,600+	61-62	Chalybeate, &c	Used commercially and as a resort.
Duffau's Sulphur Wells, Duffau Wells, Erath County.	7	.....	40	.....	Resort.
Fairview Springs, Limestone County	.....	.....	.....	.....	.....
Gooch Mineral Springs, Lampasas, Lampasas County.	.....	.....	.....	.....	.....
Gunpowder Spring, 8 miles northeast of Gilmer, Upshur County.	.....	.....	.....	.....	Has local reputation.
Hancock Springs, near Lampasas, Lampasas County.	.....	.....	.....	.....	.....
Hanna Spring, near Lampasas, Lampasas County.	1	.....	.....	Saline	.....
Hot Springs, on Rio Grande, 25 miles south of Eagle Springs, Presidio Co.	2	.....	160	.....	.....
Hot Springs, on Rio Grande, 2 miles above Hot Springs, Presidio County.	.....	.....	100	.....	.....
Hughes's Springs, Hughes Springs, Cass County.	3	.....	63	Chalybeate	Used as a resort.
Hynson's Iron Mountain Springs, 6 miles west of Marshall, Harrison Co.	15	.....	56	Chalybeate	Used commercially and as summer resort.
Kellum Sulphur Springs, 10 miles north of Anderson, Grimes County.	.....	.....	.....	.....	.....
Kendall County Mineral Spring, 3 miles west of Boerne, Kendall Co.	1	200	.....	Saline, chalybeate, and sulphureted.	Resort.
Kessler Springs, 4 miles from Alletton, Colorado County.	.....	.....	.....	Chalybeate	.....
Leonoland Spring, on Leon River and Noland Creek, near Belton, Bell Co.	.....	.....	.....	Chalybeate	.....
Martin Springs, Martin Spring, Grayson County.	1	400	60	Chalybeate	Unimproved.
Middleton Spring, near Paige, Bastrop County.	1	.....	.....	Sulphureted	Unimproved and unimportant.
<i>Mineral springs:</i>					
In Archer County	.....	.....	.....	.....	Unimproved.
In Angelina County	.....	.....	.....	.....	.....
In Brazos County	.....	.....	.....	.....	Do.

*Mineral springs of Texas*—Continued.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Mineral springs</i> —Continued.					
Two miles southwest of Linden, Cass County.			o		
Near Rusk, Cherokee County				Chalybeate and sulphureted.	
In Concho County.					
In Eastland County.					
Two miles from Harwood, Gonzales County.					
Four miles from Waelder, Gonzales County.				Acid.	
In Hardeman County.					
In Harrison County.					
At Rely Springs, Hopkins County.					
In Knox County.					
In Marion County.					
In Milam County.					
Near Mount Enterprise, Rusk Co.					
In Smith County.					
Southwest of Coffeeyville, Upshur County.					
In Tyler County.					
In Wilbarger County.					
Seven miles southeast of Will's Point, Van Zandt County.					
In Wilson County.				Chalybeate and sulphureted.	
Along Yegua River, Washington County.				Saline	
Mineral Wells, Mineral Wells, Palo Pinto County.	140				Used as resort and to some extent commercially.
<i>Mineral wells</i> :					
At Burns, Cooke County.					Has local reputation.
At Austin, Travis County.					
At Lawrence, Kaufman County.					
Moseley's Mineral Well, Bristol, Ellis County.	1		50	Saline	Unimproved.
Pate Sour Well, Sulphur Springs, Hopkins County.	1			Acid, calcic, and chalybeate.	
Pecan Spring, Lange's Mill, near Cherry Spring, Gillespie County.	1	21,600	50		
Piedmont Sulphur Springs, 10 miles northeast of Navasota, Grimes Co.					
Porter's Springs, Porter's Springs, Houston County.				Chalybeate and sulphureted.	Do.
Red Springs or Jarrett Springs, near Boston, Bowie County.					Resort.
Saratoga Springs (formerly New Sour Lake), Saratoga, Hardin County.	9	30+		Acid and saline.	Do.
Seven Springs, near Fort Davis, Presidio County.			60		
Sour Springs, near Luling, Caldwell County.	30	1,200+		Acid	Used commercially and as resort.
Sour Lake Mineral Springs, near Sour Lake, Hardin County.	13+			Acid	Do.
Sulphur Springs, Sulphur Springs, Hopkins County.	3				
Sulphur Springs, near Black Jack Springs, Fayette County.	3				Used as resort to a limited extent.
<i>Sulphur springs</i> :					
At Millican, Brazos County	8				Resort.
In Comal County					
On Plum Creek, $\frac{3}{4}$ miles east of Luling, Caldwell County.					Unimproved, but used locally.
On Sandus Creek, De Witt Co.					Local resort.
In El Paso County.					
Thirty miles west of Big Spring, Howard County.					
Near Cherry Spring, Gillespie Co.					
In Gonzales County.					
In Grimes County.					
At Jasper, Jasper County.	2				
In Johnson County.					Unimproved.

Mineral springs of Texas—Continued.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Sulphur springs—Continued.</i>			°		
At Oakville, Live Oak County.....					Unimproved.
In Pecos County.....					
In Polk County.....					
Fifteen miles north of Annona, Red River County.....					
In Somervell County.....					
On Colorado River, south of San Saba, San Saba County.....	1				Local resort.
Near Trinity, Trinity County.....					
Twelve miles from Victoria, Victoria County.....	1				
Eighteen miles west of Huntsville, Walker County.....					Unimproved.
Sutherland Springs, Sutherland Springs, Wilson County.....	{25 to 30}				Resort.
Texas Sour Springs (same as Cardwell Mineral Spring).					
Thorp's Springs, Thorp's Spring, Hood County.....	2	600		Alkaline.....	Do.
Weaver Well, Sulphur Springs, Hopkins County.....				Acid, calcic, and chalybeate.	
Wilson's Mineral Well, Beaver Creek, 15 miles west of Huntsville, Walker County.....	1			Chalybeate.....	Unimproved, but used locally.
White Sulphur Springs, White Sulphur Springs, Cass County.....	2				Used to slight extent as a resort.
Wootan Wells, Wootan Wells, 3 miles from Bremond, Robertson County.....	4		63		Used commercially and as a resort.
Wyser's Spring, 12 miles north of Huntsville, Walker County.....	1	75		Sulphureted.....	Used locally.

Analyses of mineral springs in Texas.

Constituents.	Fairview Springs.	Kendall Co. Mineral Spring.	Mineral Wells, Palo Pinto Co.	
			Palo Pinto Well.	Duke Bitter Well.
	<i>Grains per gallon.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Calcium carbonate.....			2.08	
Magnesium carbonate.....			4.66	
Sodium sulphate.....	5.65		150.05	10.98
Calcium sulphate.....	1.30		6.55	7.58
Magnesium sulphate.....	9.82		18.84	13.28
Aluminium sulphate.....	45.40			
Iron sulphate.....				0.13
Iron protosulphate.....	2.06			
Sodium chloride.....	1.76	0.84	23.98	0.95
Potassium chloride.....			1.28	
Calcium chloride.....			5.58	
Chlorine in chlorides.....		0.51		
Aluminium oxide.....		0.09	1.54	
Iron oxide.....				
Magnesia.....		6.44		
Calcium.....		45.83		
Silica.....		0.35	1.86	0.22
Sulphuric acid.....		67.25		
Volatile matter.....				
Organic matter.....			9.81	0.10
Loss.....		17.07		
Total.....	25.99	138.38	226.23	33.24

<sup>a</sup> C. F. Chandler, analyst (1884).

<sup>c</sup> Leon Routt, analyst (1884).

<sup>b</sup> A. Merrill, analyst.

<sup>d</sup> With alumina.

*Analyses of mineral springs in Texas—Continued.*

Constituents.	Pate Sour Well, at Sulphur Springs.	Sour Lake Mineral Springs.		Sour Springs, Caldwell County.
		Spring No. 7.	Spring No. 9.	
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Calcium sulphate .....	84.71			125.01
Magnesium sulphate .....	22.99	2.63	1.59	16.17
Potassium sulphate .....				100.08
Aluminium sulphate .....		45.52	31.28	} 7.58
Ferrous sulphate .....		17.20	7.71	
Iron sulphate .....	69.19			
Soluble silicates .....				12.18
Sodium chloride .....	5.02			42.74
Magnesium chloride .....				132.84
Lithium chloride .....				Trace
Silica .....	1.95			
Sulphuric acid .....	1.32	16.67	6.18	7.26
Volatile matter .....	} 3.80 {			
Organic matter .....				
Loss .....				5.12
Total .....	188.98	82.02	46.76	448.98

Constituents.	Weaver Well.	Wootan Wells.			
		Well No. 1.	Well No. 2.	Well No. 3.	Well No. 4.
	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>e</sup></i>	<i>Grains per gallon.<sup>f</sup></i>	<i>Grains per gallon.<sup>f</sup></i>	<i>Grains per gallon.<sup>f</sup></i>
Calcium carbonate .....	4.28				
Sodium sulphate .....	1.34				
Calcium sulphate .....	45.68				
Magnesium sulphate .....	24.35				
Potassium sulphate .....	0.85				
Aluminium sulphate .....	23.24				
Iron sulphate .....	33.42				
Calcium phosphate .....	0.63				
Sodium chloride .....	1.36				
Chlorine in chlorides .....		24.34	33.13	35.46	36.36
Iron protoxide .....		1.92			
Iron sesquioxide .....		0.99	11.08		13.06
Iron oxide .....					
Manganese oxide .....		0.54	0.44	} 15.05 {	} 0.57 {
Aluminium oxide .....					
Aluminium sesquioxide .....		1.22	1.56		3.46
Soda .....			14.58		18.10
Magnesia .....		13.11	11.38	17.49	22.75
Calcium oxide .....		25.21	25.89	27.10	28.11
Silica .....	1.42	3.28	2.82		4.08
Sulphuric acid .....	1.21	\$59.67	\$67.23	\$79.25	86.41
Nitrous acid .....	Trace				
Volatile matter .....	} 2.47 {	9.62		12.25	
Organic matter .....					
Total .....	140.25	139.90	168.11	186.60	212.90

<sup>a</sup> Wright and Merrill, analysts.<sup>b</sup> F. W. Mallet, analyst (1885).<sup>c</sup> H. H. Dinwiddie, analyst.<sup>d</sup> Juan K. Wright, analyst (1882).<sup>e</sup> C. F. Chandler, analyst.<sup>f</sup> W. M. Mew, analyst.<sup>g</sup> In sulphates.

## NORTHERN CENTRAL STATES.

The broad areas of Carboniferous rocks with underlying Devonian and Silurian strata that are spread over so large a portion of the Northern Central States would lead us to look in this section for mineral springs similar to those found along the western side of the Appalachians in the Atlantic States and in the northern portion of the Southern Central Division. Here, as in those sections, chalybeate, saline, and sulphureted springs predominate. Calcic springs are more numerous than in the other sections, while thermal springs are inconspicuous, such waters as are referable to this class being derived almost entirely from artesian borings.

As we proceed toward the northern part of the section and reach the metamorphic areas, the springs become more like those of the New England States.

The waters used commercially are second in number only to those so used in the Northern Atlantic States. A fair proportion of the localities are resorts, and we may expect the number so used to increase when the newer parts of the Northwestern and Western States are more thickly populated. Every year adds to the number of improved springs in these portions of the Northern Central States. Nebraska, at present, is the only State in the section for which we are unable to give a supposably complete list of mineral springs.

*Summary for Northern Central States.*

States.	Number of spring lo- calities.	Number of individual springs.	Number of springs analyzed.	Number of spring lo- calities used as resorts.	Number used com- mercially.	Total num- ber of an- alyses.
Ohio .....	80	106	15	15	7	15
Indiana .....	101	151	28	18	7	29
Illinois .....	52	91	14	6	5	14
Michigan .....	44	76	28	19	4	29
Wisconsin .....	75	146	51	15	15	58
Minnesota .....	27	39	7	2	1	7
Dakota .....	23	26	6	2	0	6
Iowa .....	32	68	14	7	4	14
Missouri .....	133	441	28	27	7	28
Nebraska .....	3	3	0	0	0	0
Kansas .....	31	129	24	11	5	24
Total .....	601	1, 276	215	122	55	224

## OHIO.

The list of Ohio mineral springs is based upon material derived from the State geological reports. The list thus obtained, supplemented by information obtained through correspondence, was submitted to the inspection of Prof. Edward Orton, of Columbus, Ohio. Speaking of the list, in a letter, he says, "It might be indefinitely extended or it might be considerably reduced." Referring to the belt of black Devonian shale that traverses the State from Lake Erie to the Ohio Valley, he says: "This formation as a rule yields but little water. The springs issuing from it, except at the very base, are weak, but they carry iron and sulphur almost everywhere. In Adams County, for example, if there is one mineral spring there are thousands. Four are credited on the list. One of these is a place of resort, but the others are identical in character with hundreds of others on all sides. They have come into recognition possibly through the superior intelligence or energy of their proprietors, who call attention to them in one way or another. What is true of Adams County is equally true of Scioto, Pike, Ross, and Pickaway, and to a less extent of the northern counties that hold the shale. The list in Delaware County might be increased to hundreds. The springs that issue from the base of the formation often have good volume, and these make a group by themselves (Mineral Springs, Adams County; Campbell's Spring, Pike County, &c.). Very much the same line of remark applies to the so-called chalybeate springs, derived from the drift formation. \* \* \* There are considerable districts in which a bed of bog-ore underlies the drift beds, and all the wells and springs in these districts might be called chalybeate."

Professor Orton thinks also that if all the calcic waters were included the list might be almost indefinitely expanded. As already intimated, we have included only those springs mentioned in the geological reports or of which definite information was secured by letter.

A complete list would perhaps include the saline and brine springs of the State, but they have been considered in another place.<sup>1</sup> A small proportion of the springs are utilized as resorts and the waters of a very limited number are used commercially.

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<sup>1</sup> See Mineral Resources of the United States, Calendar Years 1883 and 1884, article Salt, p. 836. Washington, 1885.

## Mineral springs of Ohio.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Adams County Mineral Springs, Mineral Springs, Adams County.	2	80	56	Chalybeate . . . .	Resort.
Annapolis Sulphur Spring, Crawford County.	.....	.....	.....	.....	.....
Artesian Sulphur Wells, Oak Harbor, Ottawa County.	.....	.....	.....	.....	.....
Bellbrook Magnetic Spring, Bellbrook, Greene County.	1	.....	.....	Calcic . . . . .	Used commercially and as a resort.
Bitter Artesian Well, Bryan, Williams County.	.....	.....	.....	.....	.....
Bitter Well, Hancock County.	.....	.....	.....	.....	.....
Bitter Well, New Winchester, Crawford County.	.....	.....	.....	.....	.....
Blue Rock Spring, East Cleveland, Cuyahoga County.	1	5607	60	Saline, sulphureted.	Resort.
Campbell's Spring, Pike County.	.....	.....	.....	.....	.....
Carey's Spring, Crawford County.	.....	.....	.....	.....	.....
Castalia Springs, Castalia, Erie County.	.....	.....	.....	Calcic . . . . .	.....
Cedar Springs, New Paris, Preble Co.	.....	.....	.....	.....	.....
Chalybeate springs:	.....	.....	.....	.....	.....
Opposite Bucyrus, Crawford Co.	.....	.....	.....	.....	.....
Near Darrtown, Butler County.	3	.....	.....	Chalybeate, sulphureted.	Unimproved.
At New Comerstown, Tuscarawas Co.	.....	.....	.....	.....	.....
Near Eaton, Preble County.	.....	.....	.....	.....	.....
Chalybeate and Sulphur Springs, near West Charleston, Miami County.	.....	.....	.....	.....	.....
Chenoweth's Black Sulphur Springs (formerly Mershon's), Locust Grove, Adams County.	2	.....	.....	.....	Used to small extent as a resort.
Cincinnati Artesian Well (1,245 feet), Cincinnati Gas-Works, Hamilton Co.	.....	.....	.....	Sulpho-saline . . .	.....
Cincinnati Sulpho-Saline Spring (artesian well 240 feet), Cincinnati, Hamilton County.	.....	.....	62	do . . . . .	Was used commercially and as a resort.
Copeland's Iron Spring, Locust Grove, Adams County.	.....	.....	.....	Chalybeate . . . .	.....
Crawford Sulphur Spring, Crawford Co.	.....	.....	.....	.....	.....
Cuyahoga Lithia and Magnesia Springs, 10 miles south of Cleveland, Cuyahoga County.	.....	.....	.....	Alkaline . . . . .	Used commercially.
Delaware White Sulphur Spring, campus of Wesleyan University, Delaware, Delaware County.	1	.....	.....	.....	.....
Eaton Mineral Well, Eaton, Preble Co.	.....	.....	.....	.....	.....
Electro-Magnetic Springs, near Woodstock, Champaign County.	4	1,100+	49½	.....	Used commercially and as a resort.
Erkenbrecker's Salt Well (271 feet), Ludlow Grove, Hamilton County.	.....	.....	.....	Saline . . . . .	.....
Green Mineral Spring, Green Spring, Seneca County.	1	375,000	50	.....	Do.
Howland Springs, east of Warren, Trumbull County.	.....	.....	.....	Sulphureted . . .	Resort.
Knisely's Springs, 8 miles northeast of Bucyrus, Crawford County.	11	.....	.....	.....	Summer resort.
Len-a-pe Magnetic Springs, Delaware, Delaware County.	2	700	47	Alkaline, calcic.	Used commercially and as a resort.
Lewis Centre Sulphur Springs, Lewis Centre, Delaware County.	.....	.....	.....	.....	.....
Massie's Sulphur Spring, 5 miles south of Locust Grove, Adams County.	.....	.....	.....	.....	.....
Messinger's Sulphur Spring, 2½ miles northwest of Locust Grove, Adams County.	1	60	.....	.....	Has been a resort to some extent.
Mineral springs:	.....	.....	.....	.....	.....
Near Xenia, Greene County.	.....	.....	.....	.....	.....
Near Charlestown, Portage Co.	.....	.....	.....	.....	Small and unimportant.
At Wilberforce, Greene County.	.....	.....	.....	.....	Do.
Southwest of Eaton, Preble County.	8	.....	.....	Sulphureted, &c	.....
Near Cumberland, Guernsey Co.	.....	.....	.....	.....	.....
Near Edinburg, Portage County.	.....	.....	.....	.....	.....
Near Freedom, Portage County.	.....	.....	.....	Chalybeate . . . .	Used locally.

*Mineral springs of Ohio—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Mineral springs—Continued.</i>			°		
Near Hudson, Summit County.....					
Near Idaho, Pike County.....					
Near Lodi, Medina County.....					
At Milton Centre, Wood County.....					
Near Zanesville, Muskingum Co.....					
Mineral Well, Norwalk, Huron Co.....				Saline.....	
Newark Magnetic Springs, Newark, Licking County.....					
Ohio Magnetic Spring, Magnetic Springs, Union County.....	1	750	52	Alkaline, calcic.	Used commercially and as a resort.
Smalley's Black Sulphur Spring, 6 miles east of Locust Grove, Adams Co.....					
Stryker Mineral Well, Stryker, Williams County.....	1		50	Saline.....	Resort.
Sulphur and Chalybeate Springs, Penn Township, Morrow (?) County.....					
<i>Sulphur springs:</i>					
Near Hemlock, Perry County.....					Used locally to some extent. Is a local resort.
Half mile north of Lynchburg, Highland County.....					
At Bluffton, Allen County.....					
At Harlem Springs, Carroll Co.....					Unimproved. Do.
Near Defiance, Defiance Co.....					
Near Delhi, Hamilton County.....					
Near Eaton, Preble County.....					
In Milton Township, Mahoning Co.....					
On Olentangy River, Delaware Co.....					
At New Philadelphia, Tuscarawas County.....					
In Riley Township, Putnam Co.....					
In Scioto Township, Delaware Co.....					
At Sulphur Spring, Crawford Co.....					Do.
One mile east of Zoar, Tuscarawas County.....					
Near Sulphur Grove, Montgomery County.....					
<i>Sulphur wells:</i>					
In Benton Township, Ottawa Co.....					
At Bucyrus, Crawford County.....					
In Defiance County.....					
In Ottawa Township, Putnam Co.....					
In Paulding County.....					
In Van Wert County.....					
Tawawa Springs, Wilberforce, Greene County.....	2			Chalybeate.....	Resort.
White Sulphur Springs, Adams Co.....					
White Sulphur Springs, Bath Township, Allen County.....					
White Sulphur Springs, White Sulphur, Delaware County.....					
Wyandot Magnetic Well (Matthew Orian's Well), 5 miles north of Upper Sandusky, Wyandot County.....	1	400		Sulphureted.....	Used commercially and as a resort.
Yellow Spring, Yellow Springs, Greene County.....	1	6,600	52		Once a resort; unimproved now.
Yellow Springs, Clarke County.....					

Analyses of mineral springs in Ohio.

Constituents.	Cincinnati Artesian Well.	Cincinnati Sulpho-Sa- line Spring.	Cuyahoga Lithia and Mag- nesia Springs.		Eaton's Black- Rock Well.
			Lithia Well.	Bitter Water.	
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Magnesium carbonate	8.14	9.13			14.06
Calcium carbonate	17.33	19.34	11.08	8.75	6.33
Ferrous carbonate			0.82	0.47	
Sodium sulphate			4.14	11.43	
Magnesium sulphate			116.54	172.07	
Calcium sulphate	27.27	29.20	120.39	50.16	6.07
Potassium sulphate		2.30	4.38	1.57	
Aluminium sulphate				515.51	
Sodium phosphate		1.34			
Sodium chloride	519.60	534.77	222.19	8.05	4,330.10
Magnesium chloride	18.14	17.27			542.04
Calcium chloride	22.26	22.19			786.61
Potassium chloride	3.27	3.95			
Lithium chloride			2.74	4.26	
Aluminium chloride			17.67		
Iron chloride					53.46
Sodium bromide					28.21
Magnesium bromide	0.26	0.39			
Magnesium iodide	0.19	0.30			
Iron oxide	0.37	0.43			
Silica	0.49	0.79	15.87	19.31	1.22
Loss		0.76			
Total	617.32	642.16	515.82	791.58	5,138.10
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>			
Sulphureted hydrogen	7.76	7.27			
Carbonic acid	10.32	12.63			
Total	18.08	19.90			

Constituents.	Electro- Magnetic Springs.	Green Mineral Spring.	Lenape Magnetic Springs.		Stryker Mineral Well.
			Spring No. 1.	Spring No. 2.	
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Magnesium carbonate	11.41	22.39			
Magnesium bicarbonate			15.21		
Calcium carbonate	26.24			17.73	68.30
Calcium bicarbonate			27.42		
Iron carbonate	0.16	19.70			
Iron bicarbonate					9.93
Magnesium sulphate		36.14	0.93	2.31	
Calcium sulphate		105.41	6.20	5.12	
Potassium sulphate	2.91		1.34		185.34
Iron sulphate		6.53			
Sodium chloride	13.64		3.35	2.15	231.86
Magnesium chloride	2.12				118.96
Calcium chloride	4.22		0.63		
Potassium chloride		2.48			
Potassium bromide		16.76			
Iron oxide			0.54	0.41	
Alumina		0.98		Trace	
Silica	0.24	6.10	0.05		2.63
Potassa				Trace	
Organic matter	0.39		0.03	0.81	
Hydro-sulphuric acid					4.49
Total	61.33	216.49	55.70	40.64	621.51
<i>Gas.</i>					
Carbonic acid		Cubic inches. 96.48			

<sup>a</sup> E. S. Wayne, analyst.  
<sup>b</sup> 1883.  
<sup>c</sup> E. S. Wayne, analyst (1882).

<sup>d</sup> O. N. Stoddard, analyst.  
<sup>e</sup> S. H. Douglass, analyst (1870).

*Analyses of mineral springs in Ohio—Continued.*

Constituents.	Yellow Spring, Greene Co.	Ohio Mag- netic Spring.	Bellbrook Magnetic Spring.	Cedar Springs: Washington Spring.	Blue Rock Spring.
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>e</sup></i>
Sodium carbonate.....				2.26	
Sodium bicarbonate.....					1.00
Magnesium carbonate.....			7.20	5.82	56.81
Magnesium bicarbonate.....		17.61			
Calcium carbonate.....	19.57		15.52	3.96	3.75
Calcium bicarbonate.....		19.20			
Potassium carbonate.....					6.75
Iron carbonate.....				1.32	
Iron bicarbonate.....		0.16			
Sodium sulphate.....		0.42	0.03	0.18	
Magnesium sulphate.....		2.30			
Calcium sulphate.....	1.35	3.27	1.20	1.24	
Potassium sulphate.....		0.22	1.07		
Sodium phosphate.....					5.25
Calcium phosphate.....				2.13	
Sodium chloride.....	0.15	0.79	0.85	0.98	210.25
Magnesium chloride.....	0.17				
Calcium chloride.....	1.54				
Potassium chloride.....					16.10
Lithium chloride.....					2.16
Sodium bromide.....					Trace.
Sodium iodide.....					0.20
Iron oxide.....	0.39				
Alumina.....		0.12	0.25	0.22	
Silica.....		0.24	0.67		1.00
Organic matter.....		0.57			
Total.....	23.17	44.90	26.79	18.11	303.27

<sup>a</sup> Wayne and Locke, analysts.<sup>b</sup> E. S. Wayne, analyst (1882).<sup>c</sup> N. W. Lord, analyst (1883).<sup>d</sup> A. Fennel, analyst.<sup>e</sup> J. Lang Cassells.

## INDIANA.

With the exception of Missouri, Indiana is credited in our list with more mineral-spring localities than any other of the Northern Central States. The geological formation being the same as in the neighboring States, we naturally find that the springs are also similar, and, as in Ohio, Illinois, and Kentucky, the sulphureted and chalybeate waters are most abundant. About the same number of localities are utilized for resorts as in Ohio and about as many of the waters are used commercially. We are able to present twice as many analyses as in the case of Ohio, but there are still some twenty-four springs the chemical characters of which are unknown. Brine springs exist in various portions of the State, but do not seem to be so numerous as in Ohio. The springs mentioned in the State geological reports of Prof. E. T. Cox form the basis of the list, and from the same source also many of the analyses have been taken.

Mineral springs of Indiana.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
			o		
Ague Chalybeate Springs, near Pikeville, Pike County.					
Albert's Sulphur Springs, between French Lick and West Baden, Orange County.	3				Unimproved.
Anderson Spring, on Fall Fork Creek, Bartholomew County.			53	Chalybeate	Has a local reputation.
Anderson Mound Springs, 3½ miles east of Anderson, Madison County.				do	Unimproved.
Artesian Well (900 feet), Rensselaer, Jasper County.	1	1, 200	51	Sulphureted	Improved.
Avoca Mineral Spring, Avoca, Lawrence County.	1		50	do	Local resort.
Azalia Mineral Springs, 2 miles north of Azalia, Bartholomew County.			53	Chalybeate	Has local reputation.
Barlow's Thermal Well, Shelby Co.				Sulphureted	
Benham's Carbureted Saline Well, near Mifflin, Crawford County.				Saline	
Blue Lick, Blue Lick, 1 mile east of Charlestown, Clark County.					Unimproved.
Boyer Sulphur Springs, Williamsport, Warren County.				Sulphureted	
Cameron Springs, Warren County, 4½ miles northwest of Attica.	2+	1, 100+	50	Calcic, carbonated.	Resort; water to be sold in future.
Central Springs, 5 miles east of Shoals, Martin County.	5			Chalybeate	Resort.
Chalybeate springs:					
In sec. 8, T. 8, R. 10, near Graysville, Sullivan County.					
In sec. 21, T. 11, R. 6, Clay County					
In sec. 21, T. 11, R. 5, Clay County					
Nine miles northeast of Muncie, Delaware County.					
In Rochester, Fulton County					
Chalybeate and saline springs:					
In Putnam County					
In Floyd County					
In sec. 11, T. 21, R. 8, Warren Co					
Near Brownstown, Jackson County					
In Jeffersonville, Clark County					
Near Scottsburg, Scott County					
South of Williamsport, Warren County.				Saline, chalybeate.	
Near Sheridan, Hamilton County					
Near Cambridge City, Wayne Co.					Unimproved.
Clark's Well, Crawford County					
Coats's Spring (same as West Saratoga Springs).					
Corydon Artesian Well, Corydon, Harrison County.				Saline, sulphureted.	
De Gonia Springs, De Gonia Springs, Warrick County.	2		55½	Saline, chalybeate.	Resort.
Eaton's White Sulphur Well, sec. 35, T. 3, R. 1 E., Crawford County.			59	Saline, sulphureted.	Do.
Fair Ground Springs, near Lawrence, Marion County.					
French Lick Springs, French Lick, Orange County.	13	1, 100+	55	Saline, sulphureted.	Used commercially and as a resort.
Greencastle Springs, near Greencastle, Putnam County.	3+	480	(51) to (56)	Carbonated. alkaline, chalybeate.	Resort.
Hartford Sulphur Springs, Hartford, Ohio County.				Saline, sulphureted.	Do.
Hartsville Spring, Hartsville, Bartholomew County.			53	Chalybeate	Has a local reputation.
Hawkins's Chalybeate Springs, Richmond, Wayne County.				Sulphureted, chalybeate.	
Higgins Spring, near Orangeville, Orange County.					Unimproved.
Hosea Saline Sulphur or New Point Comfort Spring, Blue Lick, Clark County.	1	1½	43	Saline, sulphureted.	Used commercially and as a resort.

*Mineral springs of Indiana — Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Huffstetter's Chalybeate Springs, near Orleans, Orange County.	.....	.....	o	.....	Has a local reputation.
Indian Springs, sec. 7, T. 4, R. 3, near Shoals, Martin County.	.....	700+	56	Saline, sulphu- rated.	.....
Indian Springs, Trinity Springs, 9 miles north of Shoals, Martin Co.	6	120	....	Alkaline, calcic, and sulphu- rated.	Used commercially and as a resort.
Inlow Springs, 4 miles southeast of Muncie, Delaware County.	2	.....	.....	Chalybeate	Has a local reputation.
Kannal Spring, Rensselaer, Jasper County.	1	1,800	53	Sulphureted	Improved.
King's Mineral Springs, 1½ miles south of Wilson's Switch, near Blue Lick, Clark County.	3	150	48	.....	Used commercially.
Knightstown Springs, 2 miles from Knightstown, Henry County.	.....	.....	.....	Chalybeate	Once used as a resort, now occupied by Sol- diers' Orphan Home.
La Fayette Artesian Well, La Fayette, Tippecanoe County.	1	480	58	Saline, sulphu- rated.	Used commercially.
Lambden's Mineral Springs, on Lost River, Orange County.	.....	.....	.....	.....	Unimproved.
Lodi Artesian Well, sec. 35, T. 18, R. 8, Fountain County.	.....	.....	.....	Saline, sulphu- rated.	.....
Mayfield's Spring, Pleasantville, Sullivan County.	.....	.....	.....	.....	Do.
Marion Artesian Well, Marion, Grant County.	.....	.....	51½	Chalybeate	.....
Milburn Springs, near Winslow, Pike County.	3	.....	.....	do	Resort.
Minerva Mineral Spring, near Lawrence, Marion County.	.....	.....	.....	.....	.....
<i>Mineral springs:</i>					
At Centreville, Wayne County	.....	.....	.....	Sulphureted	Local reputation.
Near Blue Lick, Clark County	.....	.....	.....	.....	.....
In Car Township, Clark County	.....	.....	.....	.....	.....
Near Henryville, Clark County	.....	.....	.....	Saline	Unimproved.
At New Middletown, Harrison Co.	.....	.....	.....	Saline, sulphu- rated.	Resort.
Near Muddy Fork, Monroe Town- ship, Clark County.	.....	.....	.....	.....	.....
At New Providence, Clark County.	.....	.....	.....	.....	.....
Near Pleasantville, Sullivan County	.....	.....	.....	.....	.....
Near Rensselaer, Jasper County	.....	.....	.....	Sulphureted	.....
Near Maywood, Marion County	.....	.....	.....	.....	.....
In section 17, Greene Township, Jay County.	.....	.....	.....	.....	.....
In section 35, Noble Township, Jay County.	.....	.....	.....	.....	.....
In Warren Co., near Cameron Spring	.....	.....	.....	.....	.....
Near Homer, Rush County	.....	.....	.....	.....	.....
Near Coesse, Whitley County	.....	.....	.....	.....	.....
On river bank, 1 mile from Rensse- laer, Jasper County.	.....	600 to 1,800	52	Sulphureted	.....
Four to 8 miles east of Rensselaer, Jasper County.	.....	600 to 1,800	50	do	.....
Mineral Springs and Artesian Wells, near Rushville, Rush County.	.....	.....	.....	.....	Mostly unimportant and unimproved.
Mineral Artesian Wells, West Rush- ville, Rush County.	.....	.....	.....	Chalybeate	.....
Mineral Well, New Mount Pleasant, Jay County.	.....	.....	.....	Saline	.....
Ott's Well, Mifflin, Crawford County	.....	.....	.....	do	.....
Peacock Spring, ¼ mile from Rensse- laer, Jasper County.	1	600 to 1,800	52	Sulphureted	.....
Rochester Chalybeate Spring, Roches- ter, Fulton County.	.....	.....	.....	.....	.....
Sand Creek Mineral Spring, near Azalia, Bartholomew County.	1	500	54	Chalybeate	Unimproved.

*Mineral springs of Indiana—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Shelbyville Thermal Well, Shelbyville, Shelby County.			76		
St. Ronan's Well (30 feet), Boone Township, Warrick County.	1	30	50	Saline .....	Resort.
<i>Sulphur springs:</i>					
At Sulphur Springs, Henry County		80+	30	Sulphureted ....	Local reputation
One and a half miles east of Henryville, Clark County.					Unimproved.
Near Maywood, Marion County.					
Near Rensselaer, Jasper County.					
In Lawrence County.					
On Flat Rock River, southern part of Shelby County.					
In section 17, Greene Township, Jay County.					
In section 35, Greene Township, Jay County.					
Sulphur Well, 8 miles south of Mifflin, Crawford County.					
Tar Springs, sec. 15, T. 3, R. 1 west, Crawford County.				Saline .....	Do.
Terre Haute Artesian Well, Terre Haute, Vigo County.				Saline, sulphureted.	
Thomas's Mineral Wells, Fountain Co.				Saline .....	
Trinity Springs, Trinity Springs, Martin County.	3	18,000	57	Saline, sulphureted.	Resort.
Van Cleave Mineral Springs, Crawfordsville, Montgomery County.	4			Chalybeate .....	Do.
Vickerman Springs, sec. 7, Nineveh Township, Johnson County.	3				
Vine's Springs, Vine's Springs, Ripley County.	7	400+			Do.
West Baden Springs, West Baden, Orange County.	5	1,500	57	Alkaline, saline, sulphureted.	Used commercially and as a resort.
West Saratoga Springs, West Saratoga Springs, Pike County.				Carbonated .....	Do.
White Sulphur Springs, Pike County.					
White Sulphur Springs, Bedford, Lawrence County.					
White Sulphur Springs, Indian Creek Township, Lawrence County.					
Wyandotte Spring, 5 miles northeast of Leavenworth, Crawford County.				Saline, sulphureted.	

*Analyses of mineral springs in Indiana.*

Constituents.	Anderson Mound Springs.	Benham's Carbureted Saline Well.	De Gonia Springs: Spring No. 1.	Eaton's White Sul- phur Well.	Hartford Sulphur Springs.
<i>Solids.</i>	<i>Grains per imp. gallon.<sup>a</sup></i>	<i>Grains per imp. gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per imp. gallon.<sup>b</sup></i>	<i>Grains per imp. gallon.<sup>b</sup></i>
Magnesium bicarbonate .....		215.23		20.16	11.35
Calcium carbonate .....			16.00		
Calcium bicarbonate .....	10.90	795.91		57.02	24.69
Iron carbonate .....	1.18	10.71	4.00	2.38	2.26
Sodium sulphate .....		25.84	25.00	13.15	9.67
Potassium sulphate .....		28.06	7.00	6.48	1.57
Magnesium sulphate .....		104.54	56.00	52.77	14.76
Calcium sulphate .....	6.67	34.82	4.00	13.75	7.04
Calcium phosphate .....			2.00		
Sodium chloride .....		6,025.69		150.53	72.86
Calcium chloride .....			4.00		
Magnesium oxide .....	Trace				
Alkalies .....	Trace				
Silica .....			3.00		
Alumina .....	Trace				
Iodine .....	Trace				
Insoluble silicates .....	1.66				
Loss and undetermined .....	3.59				
Total .....	24.00	7,240.80	121.00	316.24	144.20
<i>Gases.</i>	<i>Cubic inches.</i>		<i>Grains per gallon.</i>		<i>Cubic inch.</i>
Carbonic acid .....	6.473		4.00		
Sulphureted hydrogen .....					0.785

Constituents.	French Lick Springs.			Greencastle Springs.	
	Proserpine Spring.	Pluto's Well.		North or Daggy Spring.	Middle or Dew Drop Spring.
<i>Solids.</i>	<i>Grains per wine gallon.<sup>d</sup></i>	<i>Grains per imp. gallon.<sup>e</sup></i>	<i>Grains per wine gallon.<sup>f</sup></i>	<i>Grains per imp. gallon.<sup>g</sup></i>	<i>Grains per imp. gallon.<sup>g</sup></i>
Sodium carbonate .....	10.52	4.80		0.12	0.08
Magnesium carbonate .....	4.50	52.71	1.59	5.64	6.41
Calcium carbonate .....	20.29	40.18	6.95	17.47	14.27
Potassium carbonate .....		3.32		0.11	0.09
Iron carbonate .....	} 2.49	{	Trace	0.49	2.85
Aluminium carbonate .....					
Sodium sulphate .....	36.72	4.07	22.37	0.16	0.12
Potassium sulphate .....		1.21			
Magnesium sulphate .....	29.33	66.81	18.12	1.26	1.24
Calcium sulphate .....	141.00	15.61	60.59		
Aluminium sulphate .....		5.98			
Sodium chloride .....	90.92	141.90	140.54	0.95	0.84
Calcium chloride .....		32.90	5.35		
Potassium chloride .....	5.01				
Magnesium chloride .....	8.05	6.10			
Iodides .....		Trace			
Bromides .....		Trace			
Iron oxide .....		0.13			
Silica .....	1.69	0.66		0.10	0.01
Alumina .....			Trace	0.19	0.09
Loss .....				0.11	0.27
Undetermined matter .....			0.54		
Total .....	350.52	376.38	256.05	26.60	26.27
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>		<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbonic acid .....	10.116	7.337		3.62	3.58
Sulphureted hydrogen .....	17.000	6.717			
Oxygen .....		5.407			
Nitrogen .....		18.684			

<sup>a</sup> E. T. Cox, analyst (1878).<sup>b</sup> G. M. Levette, analyst.<sup>c</sup> 1876.<sup>d</sup> J. G. Rogers, analyst (1869).<sup>e</sup> E. T. Cox, analyst (1874).<sup>f</sup> J. G. Rogers, analyst.<sup>g</sup> E. T. Cox, analyst (1870).

*Analyses of mineral springs in Indiana—Continued.*

Constituents.	Hawkins's Chalybeate Springs.	Indian Springs.	Lodi Arte- sian Well.	La Fayette Artesian Well.	Marion Ar- tesian Well.
	<i>Grains per imp. gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per imp. gallon.</i>
Sodium carbonate.....	.....	4.38	.....	.....	.....
Magnesium carbonate.....	.....	22.74	0.66	0.40	2.81
Calcium carbonate.....	.....	39.73	2.01	12.02	16.80
Calcium bicarbonate.....	11.34	.....	.....	.....	.....
Potassium carbonate.....	1.40	2.89	.....	.....	0.04
Ferrous carbonate.....	0.23	.....	.....	.....	.....
Sodium sulphate.....	.....	14.20	2.13	.....	.....
Potassium sulphate.....	.....	2.88	0.80	.....	.....
Magnesium sulphate.....	1.32	36.48	3.26	.....	4.06
Calcium sulphate.....	14.03	.....	53.56	56.01	.....
Aluminium sulphate.....	.....	0.99	.....	.....	.....
Iron sulphate.....	.....	24.28	.....	.....	1.79
Calcium phosphate.....	.....	.....	1.20	0.50	.....
Sodium chloride.....	0.40	47.26	502.46	324.77	0.39
Calcium chloride.....	0.39	.....	47.93	3.72	.....
Magnesium chloride.....	.....	.07	53.54	21.66	.....
Iodides.....	.....	Trace	.....	.....	.....
Bromides.....	.....	Trace	.....	.....	.....
Magnesium bromide.....	.....	.....	0.88	.....	.....
Iron oxide.....	.....	0.01	.....	.....	.....
Silica.....	.....	0.54	0.52	0.46	1.61
Alumina.....	.....	.....	.....	.....	0.35
Manganese.....	.....	.....	.....	Trace	.....
Iodine.....	.....	.....	.....	Trace	.....
Sulphur.....	.....	.....	0.50	.....	.....
Carbonic anhydride (dioxide).....	2.44	.....	.....	.....	.....
Organic matter.....	.....	.....	.....	Trace	.....
Nitrogenous organic matter.....	.....	.....	0.80	.....	.....
Silicates.....	0.19	.....	.....	.....	.....
Total.....	32.34	196.45	672.45	419.54	27.85
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>			
Carbonic acid.....	5.1643	11.500	.....	122.02	.....
Sulphureted hydrogen.....	.....	4.000	.....	22.96	.....
Oxygen.....	.....	4.753	.....	.....	.....
Nitrogen.....	.....	7.747	.....	54.88	.....

  

Constituents.	Ott's Well.	Tar Springs.	Hosea Sa- line Sulphur Spring.	Trinity Springs.
<i>Solids.</i>	<i>Grains per imp. gallon.<sup>e</sup></i>	<i>Grains per imp. gallon.<sup>e</sup></i>	<i>Grains per imp. gallon.<sup>a</sup></i>	<i>Grains per imp. gallon.<sup>f</sup></i>
Sodium carbonate.....	.....	.....	.....	0.14
Magnesium carbonate.....	.....	.....	.....	4.93
Magnesium bicarbonate.....	107.04	2.49	.....	.....
Calcium carbonate.....	.....	.....	88.20	6.71
Calcium bicarbonate.....	401.09	25.93	.....	.....
Potassium carbonate.....	.....	.....	.....	0.08
Iron carbonate.....	14.66	4.51	.....	.....
Sodium sulphate.....	29.00	4.24	393.76	0.42
Potassium sulphate.....	11.10	2.03	111.25	0.11
Magnesium sulphate.....	42.75	10.80	11.33	5.00
Calcium sulphate.....	26.35	.....	221.42	1.52
Aluminium sulphate.....	.....	.....	11.67	.....
Sodium chloride.....	4696.76	.....	59.66	10.61
Calcium chloride.....	.....	.....	.....	0.85
Magnesium chloride.....	.....	.....	.....	1.32
Iodides.....	.....	.....	.....	} Traces
Bromides.....	.....	.....	.....	
Ferric oxide.....	.....	.....	.....	
Silica.....	.....	.....	.....	Trace
Total.....	5328.75	50.00	897.29	32.08
<i>Gas.</i>				
Sulphureted hydrogen.....	3.2	.....	.....	.....

<sup>a</sup> E. T. Cox, analyst.  
<sup>b</sup> J. C. Pohle, analyst.  
<sup>c</sup> C. M. Wetherell, analyst.

<sup>d</sup> With calcium fluoride, iron peroxide, and alumina.  
<sup>e</sup> G. M. Levette, analyst.  
<sup>f</sup> John F. Elsom, analyst (1883).

*Analyses of mineral springs in Indiana—Continued.*

Constituents.	West Saratoga Springs.		Terre Haute Artesian Well.	Thomas's Mineral Well.	Van Cleave Mineral Springs.
	Spring No. 1.	Spring No. 2.			
<i>Solids.</i>	<i>Grains per imp. gallon.<sup>a</sup></i>	<i>Grains per imp. gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Parts in 1,000.</i>	<i>Grains per gallon.<sup>c</sup></i>
Sodium carbonate .....					0.17
Sodium bicarbonate .....			0.52		
Magnesium carbonate .....					3.82
Magnesium bicarbonate .....			6.42		
Calcium carbonate .....				1.84	9.60
Calcium bicarbonate .....			25.03		
Potassium carbonate .....					0.14
Iron carbonate .....					0.62
Sodium sulphate .....					0.20
Magnesium sulphate .....					7.32
Calcium sulphate .....			2.32	0.05	
Calcium phosphate .....			Trace		
Calcium sulphide .....			Trace		
Sodium chloride .....			316.00	78.30	0.70
Calcium chloride .....			4.82	3.68	
Potassium chloride .....			1.23		
Magnesium chloride .....			6.43	0.91	
Alkaline chlorides .....		3.92			
Magnesium bromide .....			Trace		
Calcium oxide .....	2.43	3.94			
Alkalies .....	0.17				
Ferric oxide .....	2.25	2.07			
Iron oxide .....					
Silica .....					
Alumina .....	0.22	0.43	} 1.20 {	} 0.03 {	0.07
Chlorine .....	1.26	2.98			
Sulphuric acid .....	8.75	3.85			
Phosphoric acid .....	0.64	1.26			
Nitrogenous organic matter .....			1.10		
Insoluble matter .....	0.56	1.04			
Total .....	16.28	19.49	365.07	84.81	22.84
<i>Gases.</i>					
Carbonic acid .....			Present	0.02	
Sulphureted hydrogen .....			Present		

• E. T. Cox, analyst (1875).

• J. G. Pohle, analyst.

• T. M. Stevens, analyst.

Analyses of mineral springs in Indiana — Continued.

Constituents.	West Baden Springs.		Wyandotte Spring.	Cameron Springs.	St. Ronan's Well.
	Spring No. 1.	Spring No. 5.			
	<i>Grains per imp. gallon.<sup>a</sup></i>	<i>Grains per imp. gallon.<sup>a</sup></i>	<i>Grains per imp. gallon.<sup>a</sup></i>	<i>Parts in 100,000.<sup>b</sup></i>	<i>Grains in 1,000 cu. cm.<sup>c</sup></i>
Sodium carbonate.....	1.34	11.64			
Magnesium carbonate.....	47.00	7.26			
Calcium carbonate.....	49.66	22.35	3.89		
Calcium bicarbonate.....				30.353	
Potassium carbonate.....	0.75				
Iron carbonate.....					
Aluminium carbonate.....		3.60	0.23		
Sodium sulphate.....	3.73	38.13	2.21		
Potassium sulphate.....	1.64		1.04		
Magnesium sulphate.....	43.39	33.33	29.49		
Calcium sulphate.....	13.42	130.07	6.45	3.173	
Aluminium sulphate.....	5.41				
Sodium chloride.....	93.60	97.46	0.58	0.568	
Calcium chloride.....	8.73				
Potassium chloride.....		7.36			
Magnesium chloride.....	13.69	11.04			
Iodides.....	Trace				
Bromides.....	Trace				
Magnesium oxide.....				10.301	20.70
Calcium oxide.....					9.80
Iron oxide.....	0.10				Trace
Silica.....	0.53		0.20	1.653	
Alumina.....					Trace
Sodium.....					0.40
Chlorine.....					0.62
Sulphuric acid.....					65.20
Carbonic anhydride (dioxide).....			5.69		Trace
Organic matter.....					Trace
Loss.....			5.52		
Total.....	282.99	362.24	55.30	46.048	96.72
<i>Gases.</i>					
	<i>Cubic inches.</i>	<i>Cubic inches.</i>		<i>Cubic inches.</i>	
Carbonic acid.....	7.447	11.116		6.58	
Sulphureted hydrogen.....	6.821	2.505			
Oxygen.....	6.027	6.347		1.05	
Nitrogen.....	20.271	19.174		4.46	

<sup>a</sup>E. T. Cox, analyst.      <sup>b</sup>Stockder, analyst (1884).      <sup>c</sup>F. W. Achilles, analyst (1877).

## ILLINOIS.

The State of Illinois appears to have a fair proportion of mineral springs, although so far as known very few are utilized either commercially or as resorts. Chalybeate, sulphureted, and saline waters predominate. Brine springs are found in a number of counties.

The most prominent source drawn upon in the preparation of the list given here has been the *Economical Geology of Illinois*, by A. H. Worthen, published in 1882, which republishes from the original six volumes on the geology of the State all that relates to its economical geology. Comparatively few of the Illinois mineral waters have been chemically analyzed.

*Mineral springs of Illinois.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Alcyone Mineral Springs, Western Springs, Cook County.	4	2,400	50		Used commercially.
Artesian Well, Illinois City, Rock Island County.					Resort.
Carbureted Spring, 4 miles northwest of Decatur, Macon County.				Carbureted and sulphureted.	
<i>Chalybeate springs:</i>					
In Boone County.....					
On Cache River, near Ullin, Pulaski County.					
On Cedar Creek, near Reynoldsburg, Johnson County.					
Near Fairfield, Wayne County....					
Near McLeansborough, Hamilton County.					
Near mouth of Saline River, Hardin County.					
In sec. 2, T. 6 N., R. 5 E., Effingham County.					
In sec. 29, T. 11, R. 9, Hardin Co....					
In sec. 12, T. 12, R. 4, Johnson Co....					
In sec. 29, T. 19, R. 5 E., Piatt Co....					
In sec. 25, T. 11, R. 6, Pope County.					
Chalybeate Well, between Big and Talfer Creeks, Effingham County.					
De Foe's Mineral Well, McLeansborough, Hamilton County.				Chalybeate.....	
Dixon Springs, sec. 16, T. 13, R. 5, Pope County.				do.....	Resort.
Ganymede Spring, near Oregon, Ogle County.	1	3,000		Alkaline.....	Water is to be placed on sale.
Green Lawn Springs, Mount Vernon, Jefferson County.	7		(52) to (62)	Saline, chalybeate. }	Resort.
Glen Flora Springs, near Waukegan, Lake County.	2	250	45	Alkaline.....	Used commercially and as a resort.
Holderman's Artesian Well, sec. 3, T. 33 N., R. 8 E., Grundy County.				Sulphureted.....	
House's Mineral Spring, sec. 15, T. 35, R. 8, Kendall County.				do.....	
McDaniel's Mineral Springs, north of McLeansborough, Hamilton County.				Saline, sulphureted.	Unimproved.
<i>Mineral springs:</i>					
In sec. 27, T. 9, R. 8, Gallatin Co....				do.....	
In sec. 16, T. 11 S., R. 2 W., Calhoun County.				do.....	
At Jngtown, Grundy County.....					
On Mazon Creek, Grundy County....				Sulphureted.....	

Mineral springs of Illinois—Continued.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fabr.	Character of the water.	Remarks.
<i>Mineral springs—Continued.</i>					
In sec. 6, T. 32 N., R. 8 E., Grundy County.	.....	.....	o	Sulphureted ....	
In sec. 23, T. 35, R. 8, Kendall Co ...	.....	.....	.....	Sulphureted ....	
In sec. 16, T. 35, R. 8, Kendall Co. ....	.....	.....	.....	Saline .....	
Opposite Buffalo Rock, La Salle Co.	.....	.....	.....	Saline, sulphu- reted.	
At Lowell, La Salle County .....	.....	.....	.....	Saline, sulphu- reted.	
On Clark's Run, near Utica, La Salle County.	.....	.....	.....	Saline, sulphu- reted.	
At Warsaw, Hancock County ....	.....	.....	.....	Saline, chalybe- ate.	
In sec. 22, T. 11 S., R. 2 W., Union County.	.....	.....	.....	Carbureted .....	
In Washington County .....	.....	.....	.....	.....	
At Erie, Whiteside County .....	.....	.....	.....	.....	
In sec. 27, T. 2 N., R. 6 E., Wayne County.	.....	.....	.....	Saline .....	
Perry Springs, Perry Springs, near } Perry, Pike County.	3	.....	(48 to 50)	Saline, sulphu- reted, and cha- lybeate.	Used commercially and as a resort.
Phifer's Chalybeate Springs, sec. 31, T. 6 N., R. 2 E., Fayette County.	.....	.....	.....	Chalybeate .....	
Rinnah Wells Springs, near Andalusia, Rock Island County.	3	.....	.....	Carbonated .....	Used locally.
Rockford Artesian Wells, Rockford, Winnebago County.	3	.....	.....	.....	
Ross Mineral Springs, Prospect Hill, Saline County.	.....	.....	.....	Saline, sulphu- reted.	
Sailor's Springs, Sailor Springs, Clay County.	.....	.....	.....	.....	
Schuyler County Spring, Schuyler County.	.....	.....	.....	Saline, chalybe- ate.	
Spring Valley Springs, 3 miles east of Utica and 7 miles west of Ottawa, La Salle County.	20	2,000+	52	Saline, sulphu- reted.	Not improved as resort.
Sulphur Powder Spring, near Buck Horn, Brown County.	1	.....	.....	.....	Unimproved.
Versailles Mineral Springs, near Ver- sailles, Brown County.	4	.....	.....	Alkaline .....	Once a resort.
Voris & Co.'s Artesian Well, Tazewell County, opposite Peoria.	.....	.....	.....	Saline, sulphu- reted.	
Wasson's Chalybeate Spring, sec. 25, T. 11, R. 6, Pope County.	.....	.....	.....	.....	
Western Saratoga Springs (hygienic springs), Western Saratoga, Union Co.	2+	1,000+	.....	Carbonated .....	Resort.
Zonian Spring, near Elgin, Kane Co ...	.....	.....	46	.....	Used commercially.

*Analyses of mineral springs in Illinois.*

Constituents.	Alcyone Mineral Springs.	Ganymede Spring.	Glen Flora Springs.	Perry Springs.		
				No. 1. Middle Iron Spring.	No. 2. Upper Magnesia Spring.	No. 3. Lower Sulphur Spring.
	<i>Grains per imp. gall.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>d</sup></i>
Sodium bicarbonate.....		0.903	6.45	1.59	1.45	1.46
Potassium carbonate.....		9.200				
Calcium carbonate.....	18.60		15.57	15.89	19.75	19.66
Magnesium carbonate.....		8.595				
Magnesium bicarbonate.....	13.79		11.09	17.01	14.81	10.49
Iron bicarbonate.....			0.11	0.55	0.40	0.27
Sodium sulphate.....	3.39		1.85	0.44	1.10	1.49
Potassium sulphate.....	4.86	0.156				
Sodium chloride.....		0.101	0.18			
Potassium chloride.....		0.026				
Aluminium silicate.....						0.27
Potassium silicate.....				*2.64	*2.28	*3.45
Sodium silicate.....				0.12	0.38	0.58
Silica.....	0.68	0.962	0.91			
Oxide, iron and alumina.....		0.061				
Organic matter.....			0.10			
Alumina.....	1.99		0.15			
Carbonic acid (free).....	4.68					
Sulphur.....			Trace			
Total.....	48.08	20.024	36.41	38.24	40.17	37.67

Constituents.	Schuyler County Spring.	Versailles Mineral Springs.			Spring Valley Springs.		Rockford Artesian Well, No. 1.	Zonian Spring.
		No. 1.	No. 2.	Magnetic Spring.	No. 1.	No. 2.		
<i>Solids.</i>	<i>Grains per gall.<sup>a</sup></i>	<i>Grains per imp. gall.<sup>c</sup></i>	<i>Grains per imp. gall.<sup>c</sup></i>	<i>Grains per gall.<sup>a</sup></i>	<i>Grains per gall.<sup>b</sup></i>	<i>Grains per gall.<sup>b</sup></i>	<i>Parts in 1,000.<sup>f</sup></i>	<i>Grains per gall.<sup>g</sup></i>
Sodium bicarbonate.....		10.99	10.99	1.32 {				0.437
Potassium carbonate.....								
Potassium bicarbonate.....		Trace	Trace					
Calcium carbonate.....				14.60	8.96	7.28	.1396	9.563
Calcium bicarbonate.....		17.43	23.22					
Magnesium carbonate.....				8.95	3.40	4.00	.1258	2.496
Magnesium bicarbonate.....		12.57	11.78					
Ferrous carbonate.....				0.06				
Iron carbonate.....								0.499
Iron bicarbonate.....			12.14					
Sodium sulphate.....					35.16	14.56	.0095	1.747
Potassium sulphate.....							.0090	
Calcium sulphate.....	73.94	2.08		Trace	3.84	1.60		
Alkaline sulphate.....	7.84							
Magnesium sulphate.....	2.98				9.12	4.32		
Iron protosulphate.....	69.96							
Sodium phosphate.....							Trace	
Sodium chloride.....		Trace	Trace	Trace	34.80	25.28	.0062	0.707
Calcium chloride.....					33.72 {	18.16 {		
Magnesium chloride.....								
Silica.....	1.31	0.82	1.70	1.40			.0107	0.266
Alumina.....		0.73					.0009	
Organic matter.....		Trace	Trace		0.24	0.27		
Ferric oxide.....							.0006	
Total.....	156.03	44.62	49.83	26.33	129.24	75.47	.3023	15.740
<i>Gas.</i>								
Carbonic acid.....	<i>Cubic in.</i>	<i>Cubic in.</i>	<i>Cubic in.</i>	<i>Cubic in.</i>	<i>Cubic in.</i>	<i>Cubic in.</i>	<i>Cubic in.</i>	
				24.00				6.823

<sup>a</sup> Wheeler & Blaney, analysts.<sup>b</sup> E. M. Hall, analyst (1885).<sup>c</sup> J. V. Z. Blaney, analyst.<sup>d</sup> Henry Engleman, analyst.<sup>e</sup> With soda.<sup>f</sup> With iron.<sup>g</sup> G. A. Mariner, analyst.<sup>h</sup> James R. Chilton, analyst (1852).<sup>i</sup> Erastus G. Smith, analyst.<sup>j</sup> J. E. Siebel, analyst.<sup>k</sup> With trace of alumina.<sup>l</sup> With trace of iron.

MICHIGAN.

The mineral waters of Michigan are derived to a great extent from wells, which are nevertheless locally termed mineral springs. Many of these wells are artesian and were frequently sunk originally for other purposes than to find mineral waters. The artesian borings are especially in the corniferous limestone and the Huron group (Devonian). Prof. Alexander Winchell says: "The conformation of the strata has retained all their original soluble constituents; hence all artesian waters in the State, save some outlying leached-out patches of the Parma sandstone, will be found mineralized." The waters are classed as saline, carbonated, and sulphureted. The saline and sulphureted springs predominate. The brines of Michigan (which are not included in our list) form an important factor in the industries of the State, nearly half of the salt product of the United States being credited to Michigan. The supply is derived mainly from artesian borings. So-called magnetic springs are prominent. Professor Winchell says their waters are not themselves magnetic, but that marked magnetic phenomena manifest themselves about the wells.

The list, as given here, has been drawn principally from State geological reports and from an essay on the magnetic and mineral springs of the State, by Dr. Stiles Kennedy.

Mineral springs of Michigan.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Alpena Magnetic Well, Alpena, Alpena County.	.....	.....	52	Sulphureted ....	Resort.
Berrien Springs, Berrien Springs, Berrien County.	.....	.....	.....	.....	Do.
Butterworth's Magnetic Spring, Grand Rapids, Kent County.	1	.....	.....	Saline .....	Do.
Cascade Springs.....	.....	.....	.....	.....	.....
Chalybeate springs:	.....	.....	.....	.....	.....
Near Ann Arbor, Washtenaw Co. ....	.....	.....	.....	.....	.....
At Canton, Wayne County .....	.....	.....	.....	.....	.....
At Ecorse, Wayne County .....	.....	.....	.....	.....	.....
At Flat Rock, Wayne County.....	.....	.....	.....	.....	.....
At Van Buren, Wayne County.....	.....	.....	.....	.....	.....
Near Springville, Lenawee County.	.....	.....	.....	.....	Unimproved.
Eaton Rapids Magnetic Springs and Well, Eaton Rapids, Eaton County.	11	.....	.....	Calcic .....	Resort.
Erie Sulphur Springs, Erie, Monroe Co	2	.....	.....	.....	Has local reputation.
Flint's Magnetic Springs, Three Rivers, Saint Joseph County.	.....	.....	.....	Saline .....	.....
Fruitport Artesian and Magnetic Well, Fruitport, Muskegon Co.	.....	.....	48	Saline, sulphureted.	Resort.
Grand Haven Mineral Spring, Grand Haven, Ottawa County.	.....	.....	.....	Saline .....	Do.
Grand Ledge Magnetic Wells, Grand Ledge, Eaton County.	2	.....	.....	Calcic .....	Do.
Hubbardston Magnetic Spring, Hubbardston, Ionia County.	.....	.....	.....	Calcic, chalybeate.	Do.
Lansing Magnetic Well (1,400 feet) or Michigan Congress Spring, Lansing, Ingham County.	1	60?	53.5	Saline .....	Do.

*Mineral springs of Michigan—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fabr.	Character of the water.	Remarks.
Leslie Magnetic Wells, Leslie, Ingham County.	3	.....	.....	Calcic, carbonated.	Resort.
Midland Magnetic Well, Midland, Midland Co.	.....	.....	47	Saline	Do.
Mineral Well, Arcade building, Grand Rapids, Kent County.	.....	.....	.....	Calcic	.....
Moorman Well, Ypsilanti, Washtenaw County.	1	.....	57½	Saline, sulphureted.	Used commercially and as a resort.
Mount Clemens Mineral Springs, Mount Clemens, Macomb County.	2	.....	.....	Saline	Used commercially.
Ogemaw Mineral Springs, Ogemaw Springs, Ogemaw County.	8	.....	.....	Chalybeate, &c.	Local reputation.
Otsego Mineral Springs, Otsego, Allegan County.	10	.....	.....	.....	Resort.
Owosso Chalybeate Spring, Owosso, Shiawassee County.	1	.....	.....	Chalybeate	Do.
Owen's Mineral Well, Ypsilanti, Washtenaw County.	1	.....	56.6	Saline, sulphureted.	Used commercially.
Riverside Magnetic Mineral Springs, Springwell's Fort, near Detroit, Wayne County.	2	.....	50	Calcic, saline	Bathing resort.
Saint Clair Mineral Spring, Saint Clair Springs, Saint Clair County.	.....	.....	.....	Saline	.....
Saint Louis Magnetic Spring, Saint Louis, Gratiot County.	.....	.....	50	Alkaline, carbonated.	Do.
Spring Lake Magnetic Well, Spring Lake, Ottawa County.	.....	.....	52	Saline	Resort.
Shawnee Mineral Springs, Monroe, } Monroe County.	.....	.....	{ 47 } to { 49 }	Alkaline, calcic.	Sanitary resort.
<i>Sulphur springs:</i>					
In Ash Township, Monroe County.	.....	.....	.....	.....	.....
In Brownstown Township, Wayne County.	.....	.....	.....	.....	.....
In Exeter Township, Monroe Co.	.....	.....	.....	.....	.....
At Dearborn, Wayne County.	.....	.....	.....	.....	.....
Near Dundee, Wayne County.	.....	.....	.....	.....	.....
At Gibraltar, Wayne County.	.....	.....	.....	.....	.....
Near La Salle, Monroe County.	.....	.....	.....	.....	.....
Near Monroe, Monroe County.	.....	.....	.....	.....	.....
Near Raisinville, Monroe County.	.....	.....	.....	.....	.....
Warner's Spring, Albion, Calhoun Co.	.....	.....	.....	Weak alkaline, calcic.	.....
Wyandotte White Sulphur Spring, 10 miles from Detroit, Wayne County.	.....	.....	.....	Sulphureted	Bathing resort.
Ypsilanti Mineral Well, Ypsilanti, Washtenaw County.	1	.....	58.1	Saline, sulphureted.	Used commercially and as a resort.

## Analyses of mineral springs in Michigan.

Constituents.	Eaton Rapids Magnetic Springs and Well.				
	Bodine Spring.	Frost Well.	Mosher Spring.	Shaw Spring.	Sterling Spring.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per imp. gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Sodium carbonate .....	5.05		5.38	11.57	
Sodium bicarbonate .....			1.15	1.27	
Potassium carbonate .....	3.00				
Calcium carbonate .....		46.24	19.43	20.74	
Calcium bicarbonate .....	40.47				
Magnesium carbonate .....		9.11	4.52	3.84	
Magnesium bicarbonate .....	8.40				
Iron carbonate .....		2.38			2.80
Iron bicarbonate .....	2.25		1.00	2.23	
Sodium sulphate .....					12.59
Calcium sulphate .....	57.50	4.64	45.16	48.13	55.20
Magnesium sulphate .....					9.40
Sodium chloride .....	1.50	9.21	0.90	0.90	5.21
Silica .....	2.00	15.74	2.54	1.40	
Organic matter .....		0.90	0.85	0.90	
Loss .....					
Total .....	120.17	88.22	80.93	90.98	85.20
<i>Gas.</i>					
Carbonic acid .....	<i>Cubic inches.</i> 17.35	<i>Cubic inches.</i> 22.22	<i>Cubic inches.</i> 15.38	<i>Cubic inches.</i> 15.97	

  

Constituents.	Fruitport Artesian and Magnetic Well.	Alpena Mag- netic Well.	Butter- worth's Magnetic Spring.	Riverside Magnetic Springs.	
				Spring No. 1.	Spring No. 2.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per imp. gallon.<sup>b</sup></i>	<i>Grains per gallon.</i>	<i>Grains per gallon.</i>
Sodium carbonate .....					2.80
Sodium bicarbonate .....	6.52	15.74	6.00		
Calcium carbonate .....				16.40	11.15
Calcium bicarbonate .....	5.11	55.14	10.01		0.22
Magnesium bicarbonate .....	4.15	62.92	7.02		
Iron carbonate .....					0.10
Iron bicarbonate .....	7.50	1.84	1.17		
Manganese bicarbonate .....	0.10				
Sodium sulphate .....	46.00				
Calcium sulphate .....		30.06	90.19	114.42	160.77
Magnesium sulphate .....				44.32	
Sodium chloride .....	464.03	68.25	15.28	31.79	310.55
Potassium chloride .....	0.43		11.79		
Calcium chloride .....	111.11		7.33		42.58
Magnesium chloride .....	46.81		50.24	25.96	109.77
Bromide .....	0.77				
Alumina .....	Trace		0.49		0.51
Silica .....	10.60	3.09	0.62	Trace	0.21
Organic matter .....		0.92	0.80		
Loss .....					
Total .....	703.13	237.96	200.94	232.89	638.66
<i>Gases.</i>					
Carbonic acid .....	<i>Cubic inches.</i> 7.00	<i>Cubic inches.</i> 8.40		<i>Cubic inches.</i>	<i>Cubic inches.</i>
Sulphureted hydrogen .....		35.36		19.02	14.77
Nitrogen .....		0.24			

<sup>a</sup> R. C. Kedzie, analyst.  
<sup>b</sup> S. P. Duffield, analyst.  
<sup>c</sup> C. T. Jackson, analyst.

<sup>d</sup> With sodium carbonate.  
<sup>e</sup> C. G. Wheeler, analyst.  
<sup>f</sup> With calcium phosphates.

*Analyses of mineral springs in Michigan—Continued.*

Constituents.	Grand Haven Mineral Spring.	Hubbardston Magnetic Spring.	Lansing Magnetic Well.	Leslie Magnetic Wells.	Midland Magnetic Well.
<i>Solids.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per imp. gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per imp. gallon.<sup>e</sup></i>
Sodium carbonate .....	2.09		112.08	5.27	
Sodium bicarbonate .....					
Potassium carbonate .....	2.74			4.55	
Potassium bicarbonate .....					
Calcium carbonate .....	2.01	23.81	107.59	30.62	
Calcium bicarbonate .....					
Magnesium carbonate .....	1.52	10.71	23.03	10.53	
Magnesium bicarbonate .....					
Iron carbonate .....	0.08		1.88	2.27	
Iron bicarbonate .....			30.06		22.07
Sodium sulphate .....	71.29		14.94		82.19
Potassium sulphate .....				7.04	4.46
Calcium sulphate .....					1.73
Aluminium phosphate .....			320.22		32.70
Sodium chloride .....	306.03				
Potassium chloride .....	1.93				6.22
Calcium chloride .....	148.05				2.19
Magnesium chloride .....	71.53				
Magnesium iodide .....	0.05				
Magnesium bromide .....	0.17				
Calcium fluoride .....	0.05				
Iron protoxide .....		0.16			
Alumina .....	0.30				
Silica .....	1.05	0.14	3.97	2.08	2.97
Organic matter .....				0.65	2.47
Loss .....					3.21
Total .....	608.89	34.82	613.77	63.01	160.21
<i>Gas.</i>			<i>Cubic inches.</i>	<i>Cubic inches.</i>	
Carbonic acid .....			235.55	13.5	

## Mount Clemens Mineral Springs.

Constituents.	Mount Clemens Mineral Well.	Medea Spring.	Soolbad Spring.
<i>Solids.</i>	<i>Grains per gallon.<sup>f</sup></i>	<i>Grains per gallon.<sup>g</sup></i>	<i>Grains per gallon.<sup>h</sup></i>
Calcium carbonate .....	0.98	3.98	Trace
Magnesium carbonate .....	0.70	Trace	Trace
Iron carbonate .....	5.60		
Sodium sulphate .....		77.25	
Calcium sulphate .....	100.56	35.20	44.00
Potassic salts .....		Trace	Trace
Sodic salts .....		} 11,741.00	} 11,181.00
Calcic salts .....			
Magnesian salts .....			
Iron sulphide .....		Trace	
Sodium chloride .....	11,900.00	8,637.44	
Calcium chloride .....	934.50	172.41	
Magnesium chloride .....	648.48	129.60	
Magnesium iodide .....	0.07		
Magnesium bromide .....	6.37		
Iron .....			
Alumina .....	29.47	} 8.97	} 8.50
Silica .....	27.60		
Bromine .....			Trace
Iodine .....		0.32	0.05
Ammonia .....		Trace	Trace
Organic matter .....		Trace	
Total .....	13,654.33	9,065.17	11,921.07
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Hydrogen sulphide or dihydric sulphide .....	40.00	27.52	40.00
Carbonic acid .....	5.85	Trace	33.00
Nitrogen .....	Present		

<sup>a</sup> C. G. Wheeler, analyst.<sup>b</sup> P. H. Douglass, analyst.<sup>c</sup> Dr. Jennings, analyst.<sup>d</sup> R. C. Kedzie, analyst.<sup>e</sup> S. P. Duffield, analyst.<sup>f</sup> S. P. Duffield, analyst (1884).<sup>g</sup> H. F. Meier, analyst.

*Analyses of mineral springs in Michigan—Continued.*

Constituents.	Owossa Chalybeate Spring.	Spring Lake Magnetic Well.	St. Clair Mineral Spring.	St. Louis Magnetic Spring.	Otsego Min- eral Springs.
<i>Solids.</i>	<i>Grains (l) per gallon.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.</i>	<i>Grains per imp. gall.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Sodium bicarbonate.....		0.05	0.15	106.40	
Calcium carbonate.....					
Calcium bicarbonate.....	25.67	0.13		69.40	14.29
Magnesium carbonate.....			1.10		
Magnesium bicarbonate.....	19.09	0.01		17.50	1.52
Iron bicarbonate.....	15.92	1.01		1.20	2.11
Manganese bicarbonate.....		0.05			
Sodium sulphate.....		46.70			
Potassium sulphate.....					1.15
Calcium sulphate.....			140.19	66.50	0.68
Calcium silicate.....				6.72	
Sodium chloride.....		405.53	9,565.01		1.65
Potassium chloride.....	} 2.10 {	4.29			
Calcium chloride.....		113.42	2,437.49		
Magnesium chloride.....		36.20	398.38		
Chloride.....				Trace	
Bromide.....		2.17			
Lithia.....		Trace			
Alumina.....		Trace			
Silica.....	} 0.62 {	0.50	} 29.41 {	2.88	
Silicates.....					2.80
Bromine.....			Trace		
Iodine.....			Trace		
Ammonia.....		0.02			
Organic matter.....		18.29			
Loss.....				} 2.00	2.10
Total.....	63.40	628.37	12,571.73	272.60	26.30
<i>Gases.</i>					<i>Cubic inches.</i>
Hydrogen sulphide or dihydric sulphide.....			16.43	Trace	Trace
Carbonic acid.....				6.21	8.00

<sup>a</sup> C. G. Wheeler, analyst.<sup>b</sup> S. P. Duffield, analyst.<sup>c</sup> R. C. Kedzie, analyst.

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*Analyses of mineral springs in Michigan—Continued.*

Constituents.	Ypsilanti Mineral Springs.			Warner's Spring.	Wyandotte White Sulphur Spring.
	Ypsilanti Well.	Moorman Well.	Owen's Mineral Well.		
	<i>Grains per imp. gallon.<sup>a</sup></i>	<i>Grains per imp. gallon.<sup>b</sup></i>	<i>Grains per imp. gallon.<sup>c</sup></i>	<i>Grains per gallon.</i>	<i>Grains per imp. gallon.<sup>d</sup></i>
Sodium carbonate .....					30.38
Calcium carbonate .....		68.73	57.91		44.30
Calcium bicarbonate .....	36.94			16.93	
Magnesium bicarbonate .....				4.70	
Iron bicarbonate .....				1.70	
Sodium sulphate .....				2.12	25.80
Potassium sulphate .....	13.62	42.40	36.87	0.32	Trace
Calcium sulphate .....	179.96	210.78	46.64	3.39	89.21
Magnesium sulphate .....	68.07	124.52	92.43		48.35
Phosphates .....	Trace	Trace	Trace		
Borates .....	Trace	Trace	Trace		
Lithium salts .....	Trace	Trace	Trace		
Strontium salts .....	Trace	Trace			
Barium salts .....	Trace	Trace	Trace		
Ferrous salts .....	Trace	Trace	Trace		
Sodium sulphide .....	12.19	10.12			
Sodium chloride .....	832.04	1,888.35	2,411.98	1.25	22.90
Potassium chloride .....					Trace
Calcium chloride .....		172.04	209.99		
Magnesium chloride .....	57.91	153.72	133.74		
Magnesium bromide .....	3.56	13.17	13.51		
Fluorides .....	Traces		Traces		
Iron oxide .....					0.25
Alumina .....				0.25	} 1.65
Silica .....	1.40			0.18	
Silicates .....			1.07		
Silicon dioxide .....		23.79			
Organic matter .....		Trace	Trace	} 1.02 {	
Loss .....					
Carbonic acid .....					30.50
Total .....	1,205.69	2,707.62	3,004.14	31.86	293.34
<i>Gases.</i>					
Hydrogen sulphide or dihydric sulphide.	<i>Cubic inches.</i> 21.08	<i>Cubic inches.</i> 32.216	<i>Cubic inches.</i> 15.527	<i>Cubic inches.</i> .....	<i>Cubic inches.</i> 20.00

<sup>a</sup> A. B. Prescott, analyst (1883).<sup>b</sup> James H. Shepard, analyst.<sup>c</sup> J. H. Shepard and W. F. Pett, analysts (1884).<sup>d</sup> Courtis, analyst.

## WISCONSIN.

The mineral waters of Wisconsin are valuable. Many of them have wide reputations and are largely sold in all portions of the country. They are principally alkaline, chalybeate, and calcic. The list is based mainly on the Wisconsin geological reports and has also had the supervision of Prof. T. C. Chamberlin, formerly State geologist. A number of springs have been developed since the publication of the State reports and are here included.

*Mineral springs of Wisconsin.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Arctic Springs, Galesville, Trempealeau County.	3	.....	o	.....	Resort.
<i>Artesian wells:</i>					
In Madison, Dane County	4	.....	53	Alkaline	Used for city supply.
In Oil City, Monroe County	1	.....	52	Sulpho-chalybeate.	Not much used.
In Prairie du Chien, Crawford Co.	12	3,620	56	.....	.....
In Fond du Lac, Fond du Lac Co.	.....	.....	.....	.....	.....
Barnes's Spring, Delavan, Walworth County.	.....	.....	.....	.....	.....
Bethesda Spring, Waukesha, Waukesha County.	1	4,200	48	Alkaline, calcic.	Used commercially and as a resort.
Black Earth Mineral Springs, Black Earth, Dane County.	2	.....	44	Chalybeate, &c.	Do.
Bristol Soda Springs, Woodworth, Kenosha County.	.....	.....	.....	Alkaline, saline.	Unimproved.
Buckhart's Fountain, Watertown, Jefferson County.	1	700	47	.....	Do.
<i>Calcareous or travertine springs:</i>					
In sections 6 and 7, Empire Township, Fond du Lac County.	.....	.....	.....	Calcic	.....
At Lovers' Glen, Brooklyn Township, Green Lake County.	.....	.....	.....	do	.....
At Delavan, Walworth Co.	.....	.....	.....	do	.....
In section 24, southwest quarter Hartford Township, Washington Co.	.....	.....	.....	do	.....
In sections 11, 14, 15, Walworth Township, Walworth County.	.....	.....	.....	do	.....
In section 21, Taycheedah Township, Fond du Lac County.	.....	.....	.....	do	.....
In section 1, Whitewater Township, Walworth County.	.....	.....	.....	do	.....
Cedarburg Springs, Cedarburg, Ozaukee County.	.....	.....	.....	.....	.....
<i>Chalybeate springs:</i>					
In Ahnapee Township, sec. 25, range 26 east, Kewaunee County.	.....	.....	.....	.....	.....
In Byron Township, sec. 16, southeast quarter, Fond du Lac Co.	.....	.....	.....	.....	.....
In Empire Township, sec. 18, northeast quarter, Fond du Lac Co.	.....	.....	.....	.....	.....
At Grande Chute, Walworth Co.	.....	.....	.....	.....	.....
In Herman Township, sec. 29, northeast quarter, Dodge County.	.....	.....	.....	.....	.....
In Hortonia Township, section 18, Outagamie County.	2	.....	.....	.....	.....
In Lake Mills Township, section 1, north half, Jefferson County.	.....	.....	.....	.....	.....
In Whitewater Township, section 15, east quarter, Walworth Co.	.....	.....	.....	.....	.....
At Whitewater, Walworth Co.	.....	.....	.....	.....	.....
Clysmic Springs, Waukesha, Waukesha County.	.....	.....	.....	.....	.....
Crescent Spring, Waukesha, Waukesha County.	.....	.....	.....	.....	.....

*Mineral springs of Wisconsin—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Eureka Springs, Milwaukee, Milwaukee County.	.....	.....	o	.....	.....
Fountain Spring, Waukesha, Waukesha County.	.....	.....	.....	.....	.....
Gihon Springs, Delavan, Walworth Co.	8	.....	{ 46 } to { 56 }	Calcic, alkaline.	{ Used commercially and as a resort.
Glenn Springs, Waukesha, Waukesha County.	2	45,000	48	Alkaline.....	Do.
Gomber's Well, Brodhead, Green Co.	.....	.....	.....	.....	.....
Hackett's Spring, Hale's Corners, Milwaukee County.	1	.....	.....	Calcic, alkaline.	Unimproved; used locally.
Horeb Mineral Spring, Waukesha, Waukesha County.	1	1,500+	48	Alkaline, calcic.	Used commercially and as a resort.
Hunter's Magnetic Mineral Fountain (artesian), Fond du Lac, Fond du Lac County.	.....	.....	.....	.....	.....
Hygeia Spring, Waukesha, Waukesha County.	.....	.....	.....	.....	.....
Iodo-Magnesian Springs, Beloit, Rock County.	4	10,000	47	Alkaline, calcic.	Resort.
Jacob's Artesian Well, Milwaukee, Milwaukee County.	.....	18,000	.....	Calcic, saline....	.....
Jordan's Mineral Well (65 feet), Galesville, Trempealeau County.	1	.....	.....	Calcic, chalybeate.	.....
Lethean Spring, Waukesha, Waukesha County.	.....	.....	.....	.....	.....
Lowe's Spring (see Palmyra Springs).	.....	.....	.....	.....	.....
Magnetic Well, Watertown, Jefferson County.	.....	.....	.....	.....	.....
Market Square Spring, Milwaukee, Milwaukee County.	.....	.....	.....	.....	.....
Mineral Rock Spring, Waukesha, Waukesha County.	1	2,200	50	.....	Used commercially and as a resort.
<i>Mineral springs:</i>					
At Kankauna, Outagamie County.	.....	.....	.....	Sulphureted	.....
Near Sussex, Waukesha County.	.....	.....	.....	.....	Unimproved; used locally.
At East Troy, Walworth County.	2	.....	50	Calcic, alkaline.	Used locally.
Mineral Spring Artesian Well, Oil City, Monroe County.	.....	.....	.....	Sulpho-chalybeate.	.....
Nemahbin Mineral Springs, Delafield, Waukesha County.	.....	.....	.....	.....	.....
New Saratoga Springs, Star Prairie, Saint Croix County.	3	360	46	Chalybeate, carbonated.	Resort.
Norwalk Mineral Well, Norwalk, Monroe County.	.....	.....	.....	Chalybeate.....	.....
Oakton Springs, Pewaukee, Waukesha County.	.....	.....	.....	.....	.....
Oleson's Sulphur Springs, La Grange Township, section 9, Walworth Co.	.....	.....	.....	Sulphureted	.....
Park Spring, Lake Mills, Jefferson Co.	1	15	50	.....	.....
Palmyra Springs, Palmyra, Jefferson County.	{ 25 }	.....	{ 50 } to { 72 }	.....	{ Used commercially and as a sanitarium.
Periclasian Spa Springs, Whitewater, Walworth County.	.....	.....	.....	.....	.....
Rahr's Artesian Well, Manitowoc, Manitowoc County.	1	130	.....	Alkaline, calcic.	Unimproved.
Richmond Spring, Whitewater, Walworth County.	1	.....	54	.....	Used to some extent as resort.
Saint Croix Mineral Spring, near East Farmington, Polk County.	1	700	46	.....	Used commercially and as a resort.
Schweickhardt's Spring, Wauwatosa, Milwaukee County.	.....	.....	.....	.....	.....
Shealtiel Mineral Springs, near Waupaca, Waupaca County.	2	200+	40	Alkaline.....	Do.
Sheboygan Mineral Spring (artesian), Sheboygan, Sheboygan County.	1	8,400	59	Saline, calcic....	Used commercially.
Sheridan Springs, Lake Geneva, Walworth County.	{ 2 }	3,000	{ 50 } to { 53 }	.....do.....	Resort to a small extent.

*Mineral springs of Wisconsin — Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Siloam Springs, Waukesha, Waukesha County.	3	1,000+	48	.....	Used commercially and as resort.
Silurian Spring, Waukesha, Waukesha County.	.....	.....	.....	.....	.....
Sparta Mineral Wells, Sparta, Monroe County.	12	.....	50	Saline, chalybeate.	Used commercially.
Starin's Sulphur Spring, Whitewater Township, section 1, Walworth Co.	.....	.....	.....	.....	.....
Tellulah Mineral Spring (formerly Harriman's Spring), Appleton, Outagamie County.	1	? 400+	45	Saline .....	Used locally.
Utley Mineral Spring, Utley, Green Lake County.	1	10	.....	.....	Not yet improved.
Vesta Spring, Waukesha, Waukesha Co.	1	1,200	47	Calcic, saline....	Used commercially.
Waterloo Mineral Well, Waterloo, Jefferson County.	.....	.....	.....	.....	.....
White Rock Spring, Waukesha, Waukesha County.	1	800	47	.....	Do.
William's Sulphur Spring, La Grange Township, section 36, Walworth Co.	.....	.....	.....	.....	.....

*Analyses of mineral springs in Wisconsin.*

Constituents.	Arctic Springs.	Artesian Well, Madison.	Artesian Well (Wilds's), Ford du Lac.	Bethesda Spring, Waukesha.	
<i>Solids.</i>	<i>Grs. per gall.<sup>a</sup></i>	<i>Parts in 1,000.<sup>b</sup></i>	<i>Parts in 1,000.<sup>b</sup></i>	<i>Parts in 1,000.<sup>b</sup></i>	<i>Grs. per gall.<sup>c</sup></i>
Sodium bicarbonate .....	.....	0.04	.....	0.02	1.26
Calcium bicarbonate .....	13.65	0.14	0.11	0.17	17.02
Magnesium bicarbonate .....	9.84	0.12	0.08	0.13	12.39
Iron bicarbonate .....	0.26	0.01	.....	.....	0.04
Sodium sulphate .....	0.07	0.03	0.07	0.02	0.54
Calcium sulphate .....	.....	.....	0.01	.....	.....
Potassium sulphate .....	0.19	.....	.....	.....	0.46
Sodium phosphate .....	.....	.....	.....	.....	Trace
Sodium chloride .....	0.76	0.01	0.07	0.01	1.16
Calcium chloride .....	0.05	.....	.....	.....	.....
Aluminium oxide .....	0.15	.....	.....	.....	0.12
Silica .....	0.06	0.03	0.01	0.01	0.74
Organic matter .....	.....	.....	.....	.....	1.93
Total .....	25.03	0.38	0.35	0.36	35.71

  

Constituents.	Black Earth Mineral Springs.	Bristol Soda Springs.	Buckhert's Fountain.		Madison City Well.
<i>Solids.</i>	<i>Parts.<sup>d</sup></i>	<i>Grs. per gall.<sup>e</sup></i>	<i>Grs. per gall.<sup>f</sup></i>	<i>Grs. per gall.<sup>g</sup></i>	<i>Grs. per gall.<sup>h</sup></i>
Sodium carbonate .....	5.10	.....	.....	.....	.....
Sodium bicarbonate .....	.....	8.89	1.90	.....	1.09
Calcium carbonate .....	40.00	.....	.....	.....	.....
Calcium bicarbonate .....	.....	4.36	12.09	12.04	15.24
Magnesium carbonate .....	25.00	.....	.....	.....	.....
Magnesium bicarbonate .....	.....	3.21	5.82	7.94	12.98
Iron carbonate .....	12.00	.....	.....	.....	.....
Iron bicarbonate .....	.....	0.49	0.10	0.08	0.21
Sodium sulphate .....	10.00	7.74	.....	0.86	0.29
Potassium sulphate .....	0.10	.....	0.05	.....	0.24
Sodium phosphate .....	.....	.....	.....	.....	Trace
Sodium chloride .....	3.30	0.43	.....	0.66	0.29
Aluminium oxide .....	1.00	.....	.....	0.16	Trace
Silica .....	1.30	0.80	0.39	0.68	0.42
Organic matter .....	Trace	.....	0.35	.....	.....
Total .....	(i)	25.92	20.61	22.42	30.76

<sup>a</sup> W. W. Daniels, analyst.<sup>d</sup> A. C. Barry, analyst.<sup>g</sup> G. Bode, analyst (1878).<sup>b</sup> G. Bode, analyst.<sup>e</sup> A. G. Mariner, analyst.<sup>h</sup> W. W. Daniels, analyst (1882).<sup>c</sup> C. F. Chandler, analyst.<sup>f</sup> L. Brandecke, analyst.<sup>i</sup> Incomplete.

*Analyses of mineral springs in Wisconsin—Continued.*

Constituents.	Clysmic Springs.			Eureka Springs.	Fountain Spring.	Gibon Springs.
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Parts in 1,000.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Parts in 1,000.<sup>e</sup></i>
Sodium bicarbonate.....	1.26	4.431	0.803	0.13	1.02	.....
Calcium bicarbonate.....	16.04	16.153	15.896	0.41	13.78	10.27
Magnesium bicarbonate.....	13.56	9.221	8.540	0.18	9.20	7.14
Iron bicarbonate.....	0.04	0.572	0.685	.....	0.05	0.20
Sodium sulphate.....	0.56	0.693	1.076	0.26	0.36	0.93
Potassium sulphate.....	0.46	0.500	0.205	.....	.....	.....
Sodium phosphate.....	0.03	0.429	0.453	.....	.....	.....
Sodium chloride.....	1.17	0.355	0.548	3.35	Trace	0.47
Aluminium oxide.....	Trace	.....	.....	0.19	0.09	0.13
Silica.....	0.72	0.802	0.810	0.12	0.55	0.75
Alumina.....	.....	Trace	Trace	.....	.....	.....
Organic matter.....	1.62	Trace	Trace	.....	0.31	.....
Total.....	35.46	33.156	29.016	4.64	25.36	19.91

Constituents.	Glenn Springs.	Gomber's Well.	Hacket's Spring.	Horeb Mineral Spring.	Hunter's Magnetic Mineral Fountain.	Hygeia Spring.
	<i>Grains per gallon.<sup>f</sup></i>	<i>Grains per gallon.<sup>g</sup></i>	<i>Grains per gallon.<sup>h</sup></i>	<i>Grains per gallon.<sup>i</sup></i>	<i>Parts in 100.<sup>j</sup></i>	<i>Grains per gallon.<sup>k</sup></i>
Sodium carbonate.....	.....	.....	.....	.....	4	.....
Sodium bicarbonate.....	0.76	0.03	0.46	.....	.....	2.26
Calcium carbonate.....	.....	.....	.....	.....	5	.....
Calcium bicarbonate.....	15.98	6.66	8.41	10.75	.....	16.73
Magnesium carbonate.....	.....	.....	.....	.....	6	.....
Magnesium bicarbonate.....	11.58	4.86	8.23	6.88	.....	13.14
Potassium carbonate.....	.....	.....	.....	.....	4	.....
Iron bicarbonate.....	0.09	0.23	0.36	.....	13	0.58
Sodium sulphate.....	0.62	0.17	1.04	1.25	.....	0.52
Calcium sulphate.....	.....	.....	.....	.....	12	.....
Magnesium sulphate.....	.....	.....	.....	.....	17	.....
Potassium sulphate.....	0.49	.....	.....	.....	10	0.82
Sodium phosphate.....	Trace	.....	.....	.....	.....	0.04
Sodium chloride.....	1.19	0.32	0.24	0.18	14	1.25
Potassium chloride.....	.....	.....	.....	.....	3	.....
Aluminium oxide.....	0.05	0.13	0.11	0.23	.....	0.72
Silica.....	1.05	0.69	0.87	0.73	5	0.15
Iron.....	.....	.....	.....	.....	Trace	.....
Bromine.....	.....	.....	.....	.....	Trace	.....
Organic matter.....	2.21	0.18	.....	.....	.....	Trace
Loss.....	.....	.....	.....	.....	7	.....
Total.....	34.02	13.27	17.72	20.02	100	36.21

Constituents.	Iodo-Magnesian Springs.	Jacob's Artesian Well.	Jordan's Mineral Well.	Lethean Spring.	Magnetic Well, Watertown.
	<i>Grs. per gall.<sup>f</sup></i>	<i>Grs. per gall.<sup>g</sup></i>	<i>Grs. per gall.<sup>h</sup></i>	<i>Parts in 1,000.<sup>i</sup></i>	<i>Parts in 1,000.<sup>j</sup></i>
Sodium bicarbonate.....	0.14	.....	0.89	0.02	.....
Calcium bicarbonate.....	14.52	8.69	6.50	0.17	0.19
Magnesium bicarbonate.....	12.28	6.63	8.16	0.11	0.13
Iron bicarbonate.....	0.04	0.13	2.67	Trace	Trace
Sodium sulphate.....	.....	8.86	1.97	0.02	0.02
Calcium sulphate.....	0.13	14.55	.....	.....	0.01
Potassium sulphate.....	0.31	.....	.....	.....	.....
Sodium phosphate.....	0.01	.....	.....	.....	.....
Sodium chloride.....	0.34	0.64	0.18	0.01	Trace
Potassium chloride.....	.....	0.27	.....	.....	.....
Sodium bromide.....	Trace	.....	.....	.....	.....
Sodium iodide.....	Trace	.....	.....	.....	.....
Aluminium oxide.....	0.06	0.19	0.68	Trace	Trace
Silica.....	0.76	2.38	0.29	0.01	0.02
Organic matter.....	Trace	.....	0.48	.....	.....
Total.....	28.59	42.34	21.82	0.34	0.37

Rathbone, analyst.

<sup>b</sup>Ogden Doremus, analyst (1883).<sup>c</sup>G. Bode, analyst.<sup>d</sup>J. V. Z. Blaney, analyst (1873).<sup>e</sup>G. Bode, analyst (1874).<sup>f</sup>C. F. Chandler, analyst (1875).<sup>g</sup>G. Bode, analyst (1879).<sup>h</sup>E. J. Gillett, analyst.<sup>i</sup>A. Thiel, analyst.<sup>j</sup>There are 19 grains per gallon.

*Analyses of mineral springs in Wisconsin — Continued.*

Constituents.	Market Square Spring, Milwaukee.	Mineral Spring, East Troy.	Mineral Rock Spring.	Nemahbin Mineral Springs.	New Saratoga Springs.
	<i>Parts in 1,000.<sup>a</sup></i>	<i>Parts in 1,000.<sup>b</sup></i>	<i>Parts in 1,000.<sup>c</sup></i>	<i>Parts in 1,000.<sup>a</sup></i>	<i>Grs. per gall.<sup>d</sup></i>
Sodium bicarbonate .....	0.04	0.21	0.02	0.02	0.81
Calcium bicarbonate .....	0.37	0.21	0.17	0.21	4.00
Magnesium bicarbonate .....	0.36	0.14	0.14	0.09	3.07
Iron bicarbonate .....	.....	.....	.....	Trace	0.74
Sodium sulphate .....	0.03	0.02	0.02	0.02	0.08
Calcium sulphate .....	0.16	.....	.....	.....	.....
Sodium chloride .....	0.43	0.01	0.01	0.02	0.13
Potassium chloride .....	0.03	.....	.....	.....	.....
Aluminium oxide .....	.....	.....	.....	Trace	.....
Silica .....	0.04	0.02	0.02	0.02	1.04
Organic matter .....	.....	.....	Trace	.....	.....
Total .....	1.46	0.40	0.38	0.38	9.87

Constituents.	Palmyra Springs.				
	Lowe's Springs.		Bidwell Spring.	Zenobia's Fountain.	Eye Spring.
	Spring No. 1.	Spring No. 2.			
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Sodium bicarbonate .....	1.28	1.23	1.57	0.18	0.16
Calcium bicarbonate .....	12.72	12.22	9.01	12.85	9.86
Magnesium bicarbonate .....	5.77	5.54	6.48	10.14	7.92
Iron bicarbonate .....	.....	.....	0.33	.....	0.06
Sodium sulphate .....	1.19	1.14	0.28	0.40	0.64
Calcium sulphate .....	.....	.....	.....	0.79	0.30
Sodium chloride .....	1.27	1.22	0.33	0.43	0.21
Iron oxide .....	Trace	Trace	.....	.....	.....
Aluminium oxide .....	.....	.....	Trace	0.22	0.19
Silica .....	1.11	1.08	0.73	0.91	0.61
Organic matter .....	.....	.....	.....	.....	0.35
Total .....	23.34	22.43	18.73	25.92	20.30

Constituents.	Oakton Springs.	Rahr's Ar- tesian Well.	Richmond Spring.	St. Croix Mineral Spring.	Schweick- hardt's Spring.
	<i>Parts in 1,000.<sup>f</sup></i>	<i>Parts in 1,000.<sup>a</sup></i>	<i>Parts in 1,000.<sup>g</sup></i>	<i>Grains per gallon.<sup>h</sup></i>	<i>Parts in 1,000.<sup>a</sup></i>
Sodium bicarbonate .....	0.01	.....	0.04	0.79	0.01
Calcium bicarbonate .....	0.24	0.43	0.45	11.19	0.21
Magnesium bicarbonate .....	0.22	.....	0.33	7.25	0.15
Iron bicarbonate .....	0.01	.....	0.01	.....	0.01
Sodium sulphate .....	0.01	0.64	Trace	0.52	0.01
Calcium sulphate .....	.....	0.99	.....	.....	.....
Magnesium sulphate .....	.....	0.83	.....	.....	.....
Potassium sulphate .....	.....	.....	0.02	.....	.....
Sodium chloride .....	Trace	.....	0.02	0.05	Trace
Potassium chloride .....	.....	0.01	.....	.....	.....
Calcium chloride .....	.....	0.38	0.03	.....	.....
Aluminium oxide .....	Trace	.....	Trace	0.49	.....
Silica .....	0.01	0.02	0.02	0.27	0.03
Organic matter .....	Trace	.....	0.04	Trace	Trace
Total .....	0.50	3.30	0.96	20.56	0.42

<sup>a</sup> G. Bode, analyst.<sup>b</sup> G. Bode, analyst (1869?).<sup>c</sup> G. Bode, analyst (1872).<sup>d</sup> G. Bode, analyst (Sept. 9, 1875).<sup>e</sup> G. Bode, analyst (1884).<sup>f</sup> J. V. Z. Blaney, analyst (1872).<sup>g</sup> J. E. Garner, analyst (1873).<sup>h</sup> J. V. Z. Blaney, analyst (1877).<sup>i</sup> With iron.

*Analyses of mineral springs in Wisconsin—Continued.*

Constituents.	Shealtiel Mineral Springs.	Sheboygan Mineral Spring.		Sheridan Springs.	Siloam Springs.
	Grains per gallon. <sup>a</sup>	Grains per gallon. <sup>b</sup>	Grains per gallon. <sup>c</sup>	Grains per gallon. <sup>b</sup>	Parts in 1,000. <sup>b</sup>
Sodium bicarbonate .....	0.76				0.02
Calcium bicarbonate .....	6.44	1.49	13.66	12.55	0.22
Magnesium bicarbonate .....	6.36	0.28		10.28	0.13
Iron bicarbonate .....	0.05		0.50	0.11	
Manganese bicarbonate .....			0.17		
Sodium sulphate .....	0.19			0.30	0.05
Calcium sulphate .....		76.15	169.83	1.43	
Magnesium sulphate .....		89.33			
Barium sulphate .....			Trace		
Iron sulphate .....		0.74			
Calcium phosphate .....			0.04		
Sodium borate .....			Trace		
Sodium chloride .....	0.16	367.65	306.94	0.31	0.02
Potassium chloride .....			14.48		
Calcium chloride .....		109.30	27.83		
Magnesium chloride .....		9.91	54.91		
Lithium chloride .....		0.02	0.10		
Sodium bromide .....		1.06	0.19		
Sodium iodide .....		0.02	Trace		
Aluminium oxide .....	0.09	1.10	0.13	0.05	
Silica .....	0.60	0.73	0.47	0.73	0.01
Organic matter .....			Trace	0.23	
Total .....	14.65	657.88	589.25	25.99	0.45

Constituents.	Silurian Spring.	Sparta Mineral Wells.		Tellulah or Harriman's Mineral Springs.	Vesta Spring.
		Magnetic Well.	Artesian Well.		
	Grains per gallon. <sup>d</sup>	Grains per imp. gallon. <sup>c</sup>	Parts in 1,000. <sup>b</sup>	Parts in 1,000. <sup>b</sup>	Grains per gallon. <sup>b</sup>
Sodium carbonate .....		0.21			
Sodium bicarbonate .....	0.03			0.05	0.41
Calcium carbonate .....	9.93	0.40			
Calcium bicarbonate .....			0.07	0.08	13.43
Magnesium carbonate .....	6.83	4.03			
Magnesium bicarbonate .....			0.01	0.06	10.74
Barium carbonate .....		0.01			
Strontium carbonate .....		0.02			
Lithium carbonate .....		0.03			
Ammonium carbonate .....		Trace			
Iron carbonate .....	0.13	14.34			
Iron bicarbonate .....			0.01	Trace	0.05
Manganese carbonate .....		Trace			
Sodium sulphate .....	0.29	2.21		0.02	0.55
Calcium sulphate .....		0.18			
Magnesium sulphate .....			0.04		
Potassium sulphate .....		0.64			
Sodium phosphate .....		0.06			
Aluminium phosphate .....		0.06			
Iron phosphate .....	Trace				
Manganese phosphate .....	Trace				
Hydric sulphide .....		Trace			
Sodium chloride .....	0.19	0.14	0.01	0.01	0.30
Calcium chloride .....		0.61	0.01		
Sodium iodide .....		Trace			
Aluminium oxide .....	0.59				0.13
Silica .....	0.70	0.28	0.01	0.02	0.85
Organic matter .....	Trace			Trace	
Total .....	18.69	23.22	0.10	0.24	26.46

<sup>a</sup>G. Bode, analyst (1884).<sup>c</sup>C. F. Chandler, analyst (1876).<sup>j</sup>J. M. Hirsh, analyst (1876).<sup>b</sup>G. Bode, analyst.<sup>d</sup>Walter S. Haines, analyst (1880).

*Analyses of mineral springs in Wisconsin—Continued.*

Constituents.	Waterloo Mineral Well.	White Rock Spring.		Utley Mineral Spring.	Artesian Mineral Well, Prairie du Chien.	Park Spring.
	<i>Parts in 1,000.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per imp.gallon.<sup>b</sup></i>	<i>Parts in 100.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>e</sup></i>
Sodium bicarbonate.....		1.18	1.28			
Calcium.....				.0063440		
Calcium carbonate.....					0.6222	
Calcium bicarbonate.....	0.24	11.72	17.67			1.5470
Magnesium.....				.0036072		
Magnesium carbonate.....					10.9739	
Magnesium bicarbonate.....	0.28	5.31	13.02			1.3238
Iron bicarbonate.....			0.27		0.2318	0.1298
Sodium sulphate.....		1.09	1.09		12.7978	
Magnesium sulphate.....	0.21					
Potassium sulphate.....			0.82			
Calcium sulphate.....					15.3699	
Sodium nitrate.....	0.64					
Sodium chloride.....	0.42	1.17	1.12		90.2067	
Calcium chloride.....	0.51					
Magnesium chloride.....	0.13					
Lithium chloride.....	0.02					
Potassium chloride.....					3.8064	
Sodium bromide.....					0.1281	
Sodium phosphate.....					Trace	
Aluminium oxide.....			0.75			
Silica.....	9.02	1.04	1.04	{ Undeter- mined }	2.8430	0.8106
Alumina.....				.0004110	0.0610	0.0467
Iron.....				{ Undeter- mined }		
Sodium.....				Trace		
Chlorine.....				.0005000		
Sulphuric acid.....				.0013100		
Carbonic acid.....				.0118600		
Organic matter.....					Trace	
Total.....	11.47	21.51	37.06	.0240322	137.0348	3.8579

<sup>a</sup> G. Bode, analyst.<sup>b</sup> I. Campbell Brown, analyst (1874).<sup>c</sup> C. Dwight Marsh, analyst (1885).<sup>d</sup> G. Bode, analyst (1876).<sup>e</sup> Prof. Daniels, analyst.

## MINNESOTA.

The list of Minnesota springs has been compiled almost entirely from Prof. N. H. Winchell's reports on the geology and natural history of the State. No previous list credits the State with any mineral springs. In fact they are only beginning to attract attention. Although several have some local reputation, as yet only two are utilized to any considerable extent as resorts, and the water of only one is found on sale. Two salt wells have been developed in the extreme northwestern part of the State, and they have been included in the list. Big Stone Lake, which is an expansion of Minnesota River, has also been included, as the analysis shows that the water contains a large amount of sulphates and considerable silica.

*Mineral springs of Minnesota.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Big Stone Lake, Big Stone County .....	1		0	Saline .....	Local reputation.
Bryan's Mineral Spring, near Minnesota City, Winona County.				Calcic .....	
<i>Calcareous springs:</i>					
In section 22, Osborne Township, Pipe Stone County.				Calcic .....	
Near mouth of Big Stone Lake, Big Stone County.				Calcic .....	
<i>Carbureted springs:</i>					
Near Freeborn and Alden, Freeborn Co.					
<i>Chalybeate springs:</i>					
On south branch of Cottonwood, near Amiret, Lyon County.					
In sec. 16, Holly Township, Murray Co.					
In Home Township, Brown County.					
In sec. 14, Kiester Township, Faribault County.					
At southwestern end of Lake Benton, Lincoln County.					
At western end of Lake Benton, Lincoln County.	2				Do. Do.
In sec. 5, Otisco Township, Waseca Co.					
In sec. 9, Otisco Township, Waseca Co.					
In sec. 22, Manyaska Township, Martin County.					
At Schwartz Lime-Kiln, Ottawa Township, Le Sueur County.					
In Stately Township, Brown County.					
In sec. 30, Swedes Forest Township, Redwood County.					
<i>Chalybeate and sulphur springs:</i>					
In Murray County, three miles south of Walnut Grove.					
Geisinger Spring, Rochester, Olmsted Co.	1		45		Local resort.
Humboldt Salt Well, Kittson Co.					
Inglewood Springs, Minneapolis, Hennepin County.	3	156		Alkaline .....	Used commercially
<i>Mineral springs:</i>					
In Pope County .....				Chalybeate .....	Resort.
Mineral Well, Tracy Station, Lyon County.	1			Saline .....	
Owatonna Mineral Springs, near Owatonna, Steele County.	9			Alkaline, calcic.	
Salt Lake, McHurrie (?) Township, Lacqui-Parle County.				Alkaline .....	
Saint Vincent's Salt Well, Saint Vincent, Kittson County.					
Sulphur Springs, section 20, Eden Township, Pipe Stone County.	2				

Analyses of mineral springs in Minnesota.

Constituents.	Owatonna Mineral Springs.		Bryan's Mineral Spring.	Inglewood Springs.
	Vichy Spring.	Name unknown.		
	Grains per gallon. <sup>a</sup>	Grains per gallon.	Grains per gallon. <sup>b</sup>	Grains per gallon. <sup>c</sup>
Sodium carbonate.....	52.41	1.86		
Sodium bicarbonate.....				
Calcium carbonate.....			10.62	9.79
Calcium bicarbonate.....	16.37	13.20		
Magnesium carbonate.....			6.08	4.68
Magnesium bicarbonate.....	8.40	5.29		
Potassium carbonate.....			0.09	
Iron bicarbonate.....	0.54	0.62		
Lithium carbonate.....			Trace	Trace
Calcium sulphate.....				0.12
Sodium sulphate.....	0.45	0.28	0.45	0.49
Potassium sulphate.....	0.28		0.04	0.17
Sodium chloride.....	0.34	0.17	0.03	0.07
Potassium nitrate.....			Trace	
Calcium nitrite.....				Trace
Iron oxide.....				
Alumina.....	0.10	0.28	} 0.14	0.01
Manganese bicarbonate.....	Trace			
Sodium phosphate.....	Trace			
Calcium phosphate.....				Trace
Sodium iodide.....	Trace			
Organic matter.....	Trace	Trace		
Phosphates.....			Traces	
Silica.....	1.79	1.12	0.95	1.22
Free carbonic acid.....	4.34			
Total.....	85.02	22.82	18.40	16.56

Constituents.	Well at Tracy Station.	Big Stone Lake.	Humboldt Salt Well.
	Grains per gallon. <sup>d</sup>	Grains per gallon. <sup>e</sup>	Grains per gallon. <sup>e</sup>
Sodium carbonate.....	Trace		
Calcium carbonate.....	41.25	6.44	
Magnesium carbonate.....	14.70	3.67	78.60
Iron carbonate.....		0.13	1.08
Calcium sulphate.....			116.08
Sodium sulphate.....	97.58	5.58	
Magnesium sulphate.....		8.64	71.12
Potassium sulphate.....		0.73	
Magnesium chloride.....			91.44
Sodium chloride.....	Trace	0.88	2,764.99
Calcium chloride.....			42.26
Potassium chloride.....			156.55
Iron protoxide.....	0.66		
Alumina.....			2.38
Silica.....	2.27	6.21	12.15
Total.....	156.46	32.28	3,336.65

<sup>a</sup>Enno Sander, analyst (1875).

<sup>b</sup>William A. Noyes, analyst (1882).

<sup>c</sup>William A. Noyes, analyst (1883).

<sup>d</sup>G. A. Mariner, analyst.

<sup>e</sup>James A. Dodge, analyst (1884).

DAKOTA.

Information as to mineral waters in Dakota is meager and the data obtained are insufficient for the compilation of a very complete list of the springs and wells that are known to be mineralized. The Territory has not been sufficiently developed to have much attention directed to the subject. In some of the southeastern counties are springs and wells in which the water is said to be chalybeate, but correspondence with persons

in that section does not develop much in relation to them beyond the fact that they are unimproved. There are said also to be salt wells in the northeastern part of the Territory. In various portions, also, alkali is quite abundant in the soil, and in such regions the water passing through it is naturally alkaline. Such localities are found along the Little Missouri River near the crossing of the Northern Pacific Railroad and in the vicinity of the Black Hills. Newton and Jenney, in their report on the geology of the Black Hills, say: "Springs issuing from the black clay shales of the Cretaceous on Beaver Creek were found to be strongly acid and astringent to the taste, turning blue litmus red and probably containing alum and free sulphuric acid. Similar springs were reported to be found near Buffalo Gate, on the southeastern side of Black Hills." Springs in the Carboniferous rocks of this region are naturally hard, but would scarcely be classed with mineral springs. The Chicago and Northwestern Railroad Company have had a number of wells and springs on the line of their road analyzed, and several of them are mineralized. These have been included in the list and the analyses are given in the table following the list.

*Mineral springs of Dakota Territory.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Aberdeen Artesian Well, Aberdeen, Brown County.	.....	.....	.....	.....	Resort.
<i>Acid springs:</i>					
On Beaver Creek, Custer, Custer Co.	.....	.....	.....	.....	
Near Buffalo Gate, Custer, Custer Co.	.....	.....	.....	.....	
At Devil's Lake, Ramsey County	.....	.....	.....	Saline	
<i>Artesian wells:</i>					
At Clark Centre, Clark County	.....	.....	.....	Calcic Sulphur, chalybeate.	
At Devil's Lake, Ramsey County	.....	.....	.....	Saline	
At Saint Lawrence, Hand County	.....	.....	.....	.....	
Dakota Hot Springs, Hot Springs, Fall River County.	.....	.....	.....	.....	
Dunseith Mineral Spring, Dunseith, Rollette County.	1	.....	.....	.....	Unimproved.
Gary Mineral Spring, Gary, Deuel Co.	1	.....	.....	.....	
<i>Mineral springs or wells:</i>					
In Bon Homme County	.....	.....	.....	Chalybeate	
In Fall River County	.....	.....	.....	Chalybeate	
In Turner County	.....	.....	.....	.....	
Near Ree Heights, Hand County	.....	.....	.....	Saline	
On Medicine Creek, 30 miles east of Pierre, Hughes County.	.....	.....	.....	Alkaline, saline.	
Near Missouri River, at Pierre, Hughes County.	.....	.....	.....	Saline	
At foot of Bluff at Pierre, Hughes Co.	.....	.....	.....	Chalybeate, calcic, sulphur.	
On west shore of Big Stone Lake, Grant County.	.....	.....	.....	.....	Resort.
<i>Salt springs:</i>					
Near Grafton, Walsh County	.....	.....	.....	.....	
Near Pembina, Pembina County	.....	.....	.....	.....	
Sulphur Springs, Devil's Lake, Ramsey Co.	2	.....	.....	Saline	
Wamduska Lake, Wamduska, Nelson Co.	1	.....	.....	.....	Resort.
Wessington Springs, Wessington Springs, Jerard County.	3	.....	.....	Chalybeate and sulphureted.	

Analyses of mineral springs in Dakota Territory.

Constituents.	Artesian wells.			Mineral Springs or wells.		
	At Aberdeen.	At Clark Centre.	At Saint Lawrence.	Medicine Creek Spring.	Well at foot of bluff at Pierre.	Well near river at Pierre.
	Grains per gallon. <sup>a</sup>	Grains per gallon. <sup>b</sup>	Grains per gallon. <sup>b</sup>	Grains per gallon. <sup>b</sup>	Grains per gallon. <sup>b</sup>	Grains per gallon. <sup>b</sup>
Silica .....	0.9911	1.63	1.99	3.47	1.53	1.33
Iron oxide .....	0.0349					
Iron protoxide .....						
Alumina .....	0.0816		4.07	0.74	Trace	
Calcium carbonate .....	1.4157	9.68	47.14	8.42	31.31	0.19
Calcium bicarbonate .....	18.7245					9.20
Sodium carbonate .....		1.21	3.34	Trace	0.54	
Magnesium carbonate .....	0.0611	0.11		3.93	6.57	2.39
Sodium chloride .....	38.8609	0.19		8.89	4.33	1.26
Magnesium chloride .....			38.06			
Potassium sulphate .....	17.7780					
Calcium sulphate .....		1.76	4.56			
Sodium phosphate .....	Trace					
Sodium sulphate .....	49.4604		168.54	38.92	133.76	
Soda .....						21.24
Volatile matter .....	0.8123					
Total .....	128.2205	14.58	267.70	64.37	178.05	25.61

<sup>a</sup>Erastus G. Smith, analyst (1885).

<sup>b</sup>G. A. Mariner, analyst.

IOWA.

Mineral springs are not of common occurrence in Iowa, although many wells, both artesian and ordinary, are frequently mineralized. Neither Walton nor Moorman mentions any of the springs of the State. The present list is mainly the result of direct correspondence with the different spring-owners and local authorities. The springs are of the same general character as in the adjoining States. The occurrence of acid springs is interesting from a geological point of view. Colfax Mineral Spring is probably the most widely known of the places of resort.

Mineral springs of Iowa.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Acid Spring, at coal mine on Bluff Creek, Monroe County.			o		
<i>Artesian wells:</i>					
At Webster City, Hamilton County	6				
At Farmington, Van Buren County					
At Harper's Ferry, Allamakee Co.					
At Keokuk, Lee County					
Seven miles below Davenport, Scott County.					
At Dubuque, Dubuque County				Slightly sulphureted.	
At Lansing, Allamakee County					
At McGregor, Clayton County					
Chamberlain (or Storm Lake) Mineral Springs, Storm Lake, Buena Vista Co.	3	2,000	48	Saline	Local resort.
Cherokee Magnetic Mineral Springs, Cherokee, Cherokee County.					Used commercially and as a resort.
Colfax Mineral Springs, Colfax, Jasper County.	8	960	52	Saline, chalybeate.	Do.
Dunbar's Mineral Spring, near College Springs, Page County.	1	100	56	Calcic	Sold to limited extent and used as a resort.
Big Mineral Spring and Flowing Wells, Rosenkrans Park, Webster City, Hamilton County.	5	6,400	33		Used locally.

*Mineral springs of Iowa—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Gypsum Spring, Fort Dodge, Webster County.			o	Alkaline.....	
Henryson's Artesian Well, Story City, Story County.				Chalybeate.....	Unimproved.
Iowa Acid Spring, Eddyville, Wapello County.	2			Acid.....	Local reputation.
Kinersly's Well, 1 mile from Keosauqua, Van Buren County.				do.....	
Linwood Spring, Linwood, Scott Co.	1	30,000	56		Resort.
Magnetic Spring, Lehigh, Webster Co.					Used locally.
Maulsby's Spring (well), 3 miles north of Dexter, Dallas County.	1	400+		Saline.....	Local reputation.
<i>Mineral springs:</i>					
At Fellow's Grove, Carroll County.					
At Iowa City, Johnson County.					
Near Big Spring, Wayne County.					
Mineral Wells (artesian), north of Ames, Story County.	16		47	Chalybeate.....	Unimproved.
Ottumwa Medical Springs, Ottumwa, Wapello County.	1	40	54	Alkaline, saline.	Unimproved, one is supposed to have medicinal effects.
Phoenix Mill Sulphur Spring, Davenport, Scott County.					Used as a resort and commercially.
Prospect Park Mineral Springs, Des Moines, Polk County.					
Siloam Springs, Iowa Falls, Hardin Co.	2	420	48	Alkaline, calcic.	Sanitarium.
Sulphur and Iron Wells, Howard Co.					
Sulphur Springs, Sulphur Springs, Buena Vista County.	2			Sulphur.....	
Watkins's Artesian Well, Story City, Story County.				Carbureted and calcic.	Unimproved.

*Analyses of mineral springs in Iowa.*

Constituents.	Colfax Mineral Springs (Old M. C. Spring).	Dunbar's Mineral Spring.	Iowa Acid Spring.	Artesian Well, Farmington.	Mineral Spring, Fellow's Grove.
	<i>Grains per gallon. <sup>a</sup></i>	<i>Grains per gallon. <sup>b</sup></i>	<i>Grains per gallon. <sup>c</sup></i>	<i>Grams per liter. <sup>d</sup></i>	<i>Grams per liter. <sup>d</sup></i>
Magnesium carbonate.....		3.81			
Calcium carbonate.....	17.51	8.41			
Iron carbonate.....	0.67	3.57			
Sodium sulphate.....	78.86		0.37		
Potassium sulphate.....	0.41				
Magnesium sulphate.....	31.87	3.76	13.86		
Calcium sulphate.....	13.07		44.65		
Iron sulphate.....		1.14	97.30		
Sodium chloride.....	3.85	2.84			
Magnesium chloride.....			0.82		
Magnesium bromide.....		Trace			
Calcium oxide.....				0.44	0.43
Iron oxide.....					0.04
Magnesium oxide.....				0.18	0.24
Sodium silicate.....			15.89		
Silica.....	0.29	0.59			
Alumina.....			226.41		
Sulphuric acid.....			408.99	1.33	1.58
Lithia.....	Trace				
Carbon dioxide.....	7.18		8.10		
Ammonium crenate.....		1.27	Traces		
Organic matter.....		Trace			
Phosphoric acid.....				0.23	
Hydrochloric acid.....				0.02	
Iron.....					
Insoluble.....					
Total.....	153.71	25.39	816.39	2.20	2.29
<i>Gas.</i>		<i>Cubic inches.</i>			
Carbonic acid.....		42.30			

\* G. Hinrichs, analyst.    <sup>b</sup> J. H. Wright, analyst.    <sup>c</sup> J. H. Seibel, analyst (1882).    <sup>d</sup> Rush Emery, analyst.

*Analyses of mineral springs in Iowa—Continued.*

Constituents.	Gypsum Spring, Fort Dodge.	Artesian Well, Harper's Ferry.	Artesian Well, near Daven- port.	Chamberlain or Storm Lake Mineral Springs.	Cherokee Magnetic Min- eral Springs.
	<i>Grams per liter.<sup>a</sup></i>	<i>Grams per liter.<sup>a</sup></i>	<i>Grams per liter.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Magnesium carbonate.....			0.02		8.21
Calcium carbonate.....			0.02		5.93
Lime.....				14.46	
Iron carbonate.....					11.26
Sodium bicarbonate.....					0.01
Sodium carbonate.....			0.29		0.31
Sodium.....				0.47	
Sodium sulphate.....			0.49		0.37
Potassium.....				1.35	
Magnesia.....				6.13	
Iron phosphate.....					0.73
Chlorine.....				0.11	
Sodium chloride.....			0.14		
Magnesium oxide.....	0.07	0.04			
Calcium oxide.....	0.45	0.10			
Oxygen.....				0.41	
Silica.....				3.56	0.82
Alumina.....			{ 0.06 }		0.29
Sulphuric acid.....	1.06	0.08		25.02	
Organic matter.....				2.50	
Hydrochloric acid.....		0.10			
Iron and alumina oxides.....				0.18	
Carbonic acid for magne- sia.....				5.51	
Hydrogen for the magne- sia.....				0.25	
Total.....	1.58	0.41	1.02	59.95	27.93
<i>Gas.</i>					
Carbonic dioxide.....					<i>Cubic inches.</i> 59.30

Constituents.	Ottumwa Med- ical Springs.	Henryson's Artesian Well.	Watkins's Artesian Well.	Siloam Springs.
	<i>Grs. per gall.<sup>a</sup></i>	<i>Gms. per liter.<sup>f</sup></i>	<i>Gms. per liter.<sup>f</sup></i>	<i>Grs. per gall.<sup>e</sup></i>
Magnesium carbonate.....	30.80	0.1134	0.1246	
Calcium carbonate.....	22.26	0.1910	0.1990	
Iron carbonate.....	2.94			
Sodium bicarbonate.....				2.5003
Sodium.....		0.0417	0.1155	
Calcium bicarbonate.....				18.1116
Magnesium bicarbonate.....				10.2316
Protoxide of iron bicarbonate.....				0.0702
Sodium sulphate.....	200.88			0.4270
Potassium sulphate.....	2.23			
Calcium sulphate.....	38.23			
Sodium chloride.....	51.81	0.0016		0.0750
Silica.....	7.30	Trace	0.0250	0.8290
Alumina.....	Trace			0.1170
Organic matter.....	Trace			Trace
Iron and alumina oxides.....		0.0135	0.0060	
Loss.....		0.0008	0.0009	
Total.....	356.45	0.3620	0.4710	32.3617

<sup>a</sup>Rush Emery, analyst.<sup>b</sup>Walter L. Brown, analyst.<sup>c</sup>John W. Draper, analyst (1881).<sup>d</sup>With loss.<sup>e</sup>James Carter, analyst (1883).<sup>f</sup>F. W. Clarke, analyst (1885).<sup>g</sup>Gustavus Bode, analyst.

## MISSOURI.

This State is rich in mineral springs, which are of great variety. Only about one-fifth of them are improved, but among the latter are several that are well known throughout the State.

As far as known the springs are very similar to those of the neighboring States, saline, sulphureted, and chalybeate springs predominating.

Many of the counties have salt springs or wells, and at one time the production of salt from them was a considerable industry. The list of springs given here has been compiled mainly from the State geological reports and from various hand-books. The present status of the various springs has been determined, whenever practicable, by direct correspondence with the spring-owners.

*Mineral springs of Missouri.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fabr.	Character of the water.	Remarks.
<i>Alum wells:</i>			o		
In section 3, township 32, range 29, Barton County.	.....	.....	.....	.....	
In section 35, township 33, range 29, Barton County.	.....	.....	.....	.....	
In section 23, township 33, range 33, Barton County.	.....	.....	.....	.....	
In Milford, Barton County	.....	.....	.....	.....	
Arlington Springs, 8 miles south of Marshall, Saline County.	20	.....	65	Saline, sulphureted, &c.	
Arnica Springs, near Stockton, Cedar County.	.....	.....	.....	.....	
Aurora Springs, Aurora Springs, Miller County.	3	300	.....	Saline	Resort.
Belcher's Artesian Well (2,199 feet), } Saint Louis, Saint Louis County. }	1	.....	{ 73 } to { 74 }	do	
Bethesda Springs, near Stockton, Cedar County.	.....	.....	.....	.....	
Big Salt Springs, West of Marshall, Saline County.	.....	.....	60	Sulpho-saline	
Blankenship's Medical Springs, 2½ miles north of Houston, Texas Co. }	100	2,000+	{ 59 } to { 75 }	.....	Do.
Boone's Lick, Boonesborough, Howard County.	.....	.....	.....	.....	
Bowsher Mineral Spring, 1½ miles north of Princeton, Mercer County.	.....	200+	50	Chalybeate	Do.
Bratton Spring, near Columbia, Boone County.	.....	.....	.....	.....	
Buffalo Spring, near Louisiana, Pike County.	.....	.....	.....	.....	
Burkhart's Spring, 2 miles west of Franklin, Howard County.	.....	.....	.....	.....	
Cedar Springs, 7 miles east of Eldorado Springs, Cedar County.	7	200	47	Chalybeate	Do.
<i>Chalybeate springs:</i>					
On Hog and Hazel Creeks, Adair County.	.....	.....	.....	.....	
East of Butler, Bates County	.....	.....	.....	.....	
In section 9, township 33, range 28, Cedar County.	.....	.....	.....	.....	
In section 22, township 34, range 28, Cedar County.	.....	.....	.....	.....	
At Dripping Spring, Boone Co.	.....	.....	.....	.....	
At Twin Springs, Boone (?) Co.	.....	.....	.....	.....	

*Mineral springs of Missouri* — Continued.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Chalybeate springs</i> —Continued.			o		
Near Mount Moriah, Harrison Co.	.....	.....	.....	.....	.....
Six miles north of Knobnoster, Johnson County.	.....	.....	.....	.....	.....
Ten miles south of Warrensburg, Johnson County.	.....	.....	.....	.....	.....
In section 12, township 62, range 10 west, Knox County.	.....	.....	.....	.....	.....
At Lexington, La Fayette County.	.....	.....	.....	.....	.....
On Bryant's Creek, Lincoln Co.	.....	.....	.....	.....	.....
Near Louisville, Lincoln County.	.....	.....	.....	.....	.....
West of Sharpsburg, Marion Co.	.....	.....	.....	.....	.....
At Jacksonville, Randolph Co.	.....	.....	.....	.....	.....
In section 34, township 64, range 21, Sullivan County.	.....	.....	.....	.....	.....
West of Osceola, Saint Clair Co.	.....	.....	.....	.....	.....
Near Smithton, Worth County.	.....	.....	.....	.....	.....
Choteau Springs, 10 miles from Boonville, Cooper County.	4	600	58	.....	Has local reputation, but no improvements at present.
Cheltenham Springs, Cheltenham (I), Saint Louis County.	.....	.....	.....	.....	.....
Clark's Sulphur Springs, 5 miles from Warsaw, Benton County.	.....	.....	.....	.....	.....
Climax Springs, Climax, Camden Co.	7	.....	{ 58 to 59 }	Saline .....	Resort.
Cole's Springs, Marshall, Saline Co.	4	.....	.....	Saline, sulphureted, chalybeate.	Do.
Columbia Chalybeate Springs, Boone County.	.....	.....	.....	.....	.....
Copperas or Sweet Sulphur Springs, Sec. 33, T. 51, R. 2 W., Lincoln Co.	2	90	60	.....	Unimproved.
Crystal Springs, McDonald County.	.....	.....	.....	.....	.....
Davis's Sulphur Springs, Pike Co.	.....	.....	.....	.....	.....
Dawson's Springs, East of Osceola, Saint Clair County.	.....	.....	.....	.....	.....
Dixon Springs, Cureall, northwest of West Plains, Howell Co.	50	1,300+	.....	.....	Resort and used commercially to some extent.
Eldorado Springs, Eldorado Springs, Cedar County.	3	180+	.....	.....	Used as a resort and commercially.
Eldorado Springs, section 1, township 21, range 5 west, Oregon Co.	50	500+	.....	Chalybeate .....	Resort.
Elk Springs, Elk Lick Springs, Pike County.	3	.....	.....	Saline?.....	Summer resort.
Ellis Well, near Nevada, Vernon Co.	.....	.....	.....	.....	.....
Excelsior Springs, Excelsior Springs, Clay County.	4	.....	.....	Saline .....	.....
Fairview Mineral Spring, Denver, Worth County.	1	.....	50	Chalybeate, saline.	Resort.
Fike's Lick Spring, 2 miles from Elk Lick Springs, Pike County.	1	.....	.....	Saline?.....	Unimproved.
Ford Springs, on Big Ransom, Pike County.	.....	.....	.....	.....	.....
Goreham's Lick, Randolph County.	.....	.....	.....	.....	.....
Hagenbush Spring, Cabool, Texas County.	1	.....	.....	.....	Do.
Harriman's Sulphur Spring, Cooper County.	.....	.....	58	.....	Do.
Houtze's Sulphur Springs, section 1, township 36, range 29, Vernon Co.	.....	.....	.....	.....	.....
Hunter's Epsom Well, Nevada, Vernon County.	.....	.....	.....	.....	.....
Indian Springs, Indian Springs, } McDonald County. }	4	48	{ 57 to 67 }	.....	Resort to a limited extent.
Jericho Springs, Jericho, Cedar Co.	2	100	.....	.....	Local resort.
Landreth's Mineral Well, Knox City, Knox County.	.....	1	.....	Saline, chalybeate.	Resort.
Le Outre Lick Springs, west of Danville, Montgomery County.	.....	.....	.....	.....	.....

*Mineral springs of Missouri—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Lewis Spring, 1½ miles from Glasgow, Howard County.	.....	.....	o	.....	.....
Lindsay's Lick, near junction of Big and Little Ramsey, Pike County.	.....	.....	.....	.....	.....
Louis Spring, Greenfield, Dade Co.	1	.....	.....	Chalybeate	Resort.
McAllister Springs, on Blackwater Creek, Saline County.	.....	.....	.....	.....	.....
Meramec Springs, near Nasby, Saint Louis County.	.....	.....	.....	.....	.....
Merriwether's Epsom Springs, Pike County.	.....	.....	.....	.....	.....
Mineral Springs, Panacea, Barry Co.	.....	.....	.....	.....	Do.
<i>Mineral springs:</i>	.....	.....	.....	.....	.....
Six miles east of Cassville, Barry County.	.....	.....	.....	.....	.....
In section 18, township 40, range 32, Bates County.	.....	.....	.....	Saline	.....
In section 22, township 40, range 29, Bates County.	.....	.....	.....	do	.....
In Elston, Cole County.	.....	.....	.....	Sulphureted, saline.	.....
Near Elston, Cole County.	.....	.....	.....	Alkaline.	.....
Two miles from Knobnoster, Johnson County.	.....	.....	.....	.....	.....
Three miles northwest of Warrensburg, Johnson County.	.....	.....	.....	.....	.....
Near Spring Hill, Livingston Co.	.....	.....	.....	Saline, sulphureted.	.....
One and one-half miles from Lane's Prairie, Maries County.	.....	.....	.....	.....	.....
In McDonald County	.....	.....	51	.....	.....
On Blackwater Creek, near Tenny Creek, Saline County.	.....	.....	.....	.....	.....
Near Honston, Texas County.	.....	.....	.....	.....	.....
Eight miles southeast of Marshall, Saline County.	4	.....	.....	.....	.....
Near Glasgow, Howard County	2	.....	.....	.....	.....
Mineral Well, west of Crescent Hill, Bates County.	.....	.....	.....	Saline	.....
Mint Spring, 5 miles northeast of Hartville, Wright County.	.....	.....	.....	.....	.....
Monagaw Sulphureted Springs, 10 miles from Osceola, Saint Clair Co.	.....	.....	.....	.....	.....
Montesano Springs, near Sulphur Springs Landing, Jefferson County.	10	150	60	Saline, sulphureted.	Used commercially and as a resort.
Mooreville Mineral Springs, Mooreville, Livingston County.	.....	.....	.....	Calcic, saline	Resort and used commercially.
Nevada Mineral Springs, Nevada, Vernon County.	3	825	47	Sulphureted	Resort.
New Baden Springs, 12 miles west of Kirksville, Adair County.	5	500+	62	Alkaline, calcic.	Once a resort, now unimproved.
Osceola Springs, ½ mile from Dripping Spring, Boone County.	.....	.....	.....	.....	.....
Paris Chalybeate Springs, Paris Springs, Lawrence County.	3	250+	50	Chalybeate	Resort.
Quitman Red Sulphur Springs, near Quitman, Nodaway County.	.....	.....	.....	.....	.....
Randolph Medical Springs, Medical Springs, Randolph Co.	2	2,200+	{ 52 to 54 }	.....	Used commercially and as a resort.
Reiger Spring, Mercer County, near Lineville, Iowa.	1	40	50	Saline	Resort and used commercially to some extent.
Rocheport Sulphur Springs (or Adams Springs), Rocheport, Boone County.	4	.....	.....	Sulpho-saline	Local resort.
Salt Springs, Salt Springs, Saline Co.	.....	.....	.....	.....	.....
Saratoga Springs, Saratoga, McDonald County.	.....	.....	.....	.....	.....
Siloam Springs, Siloam Springs, Howell County.	15	.....	{ 50 to 68 }	Alkaline, saline.	Resort.

Mineral springs of Missouri—Continued.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Spaulding Springs, Ralls County, 12 miles southwest of Hannibal.	4	2 400	o	Saline, chalybeate.	Resort.
Stice's Spring, $\frac{1}{2}$ mile from Dripping Spring, Boone County.	1	.....	105	Saline, calcic .....	.....
Saint Louis Artesian Well (3,843 feet), Insane Asylum, Saint Louis, Saint Louis County.	3	100	45	.....	Once used as a resort.
Sulphur Springs, Sulphur Springs Landing, Jefferson County.	.....	.....	.....	.....	.....
Sulphur springs:	.....	.....	.....	.....	.....
In section 27, township 34, range 30, Vernon County.	.....	.....	.....	.....	.....
In section 16, township 35, range 29, Vernon County	.....	.....	.....	.....	.....
One-half mile north of Wright City, Warren County.	.....	.....	.....	.....	.....
In Marion County.....	.....	.....	.....	.....	.....
In eastern part of Bates County..	.....	.....	.....	.....	.....
In Benton County.....	.....	.....	.....	.....	Unimproved.
Two miles from Elston, Cole Co..	.....	.....	.....	.....	Do.
In Cooper County.....	.....	.....	.....	.....	.....
Near Fayette, Howard County...	.....	.....	.....	Saline, sulphureted.	.....
In section 33, township 49, range 15, Howard County.	.....	.....	.....	.....	.....
Near Franklin, Howard County..	.....	.....	.....	.....	.....
In Jefferson County.....	.....	.....	.....	.....	.....
On Cuivre River, Lincoln County.	.....	.....	.....	.....	.....
On Lick Creek, northwest of Ely, Marion County.	.....	.....	.....	.....	.....
In section 6, township 53, range 1 west, Pike County.	.....	.....	.....	.....	.....
At Saverton, Ralls County.....	.....	.....	.....	.....	.....
Trabues Lick, near Spencer Creek, Ralls County.	.....	.....	.....	.....	.....
In section 33, township 56, range 5 west, Ralls County.	.....	.....	.....	.....	.....
On Davis Creek, Saline County ..	.....	.....	.....	.....	.....
Five miles west of Osceola, Saint Clair County.	.....	.....	.....	.....	.....
Twenty miles from Saint Louis, Saint Louis County.	.....	.....	.....	.....	.....
In section 23, township 34, range 30, Vernon County.	.....	.....	.....	.....	.....
Sulphur Well, section 18, township 40, range 32, Bates County.	.....	.....	.....	.....	.....
Sweet Springs, near Huntsville, Randolph County.	.....	.....	.....	.....	.....
Sweet Springs, near Brownsville, Saline County.	5	224, 000+	54	Saline .....	Used commercially and as a resort.
Twin Springs, McDonald County ....	.....	.....	.....	.....	.....
White Sulphur Springs, 15 miles northeast of Osceola, Saint Clair Co.	.....	.....	.....	.....	.....
White Sulphur Springs; 8 miles from Warsaw, Benton County.	.....	.....	.....	.....	.....
Zodiac Springs, Zodiac, Vernon } County. }	12	.....	$\left\{ \begin{smallmatrix} 48 \\ \text{to} \\ 52 \end{smallmatrix} \right\}$	Saline, chalybeate. }	Resort. }

*Analyses of mineral springs in Missouri.*

Constituents.	Aurora Springs.	Boone's Lick.	Bowsher Mineral Spring.	Bratton Spring.	Burkhart's Spring.
	<i>Grs. per gall.</i>	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. per gall.<sup>b</sup></i>	<i>Grs. per gall.<sup>c</sup></i>	<i>Grs. per gall.<sup>a</sup></i>
Calcium bicarbonate			5.5980		
Magnesium bicarbonate			0.9089		
Iron carbonate	5.130				
Ferrous bicarbonate			4.7639	2.63	
Manganese bicarbonate			0.0655		
Sodium sulphate			0.2208		
Calcium sulphate	2.427	119.27		64.19	135.08
Magnesium sulphate			0.2286	15.73	
Potassium sulphate			0.7445		
Aluminium tersulphate				52.45	
Ferrous sulphate				36.74	
Calcium phosphate			0.0245		
Sodium chloride	4.009	972.29	1.0973	1.31	1,082.48
Calcium chloride		81.47			93.74
Magnesium chloride	6.949				116.89
Aluminium oxide			0.6484		
Lithia	1.430				
Ferrous oxide	0.933				
Silica			4.7896	2.53	
Carbonic acid				11.95	
Free carbonic acid			3.0541		
Total	20.878	1,173.03	22.1441	187.53	1,428.19

  

Constituents.	Choteau Springs.	Columbia Chalybeate Springs.	Climax Springs.	Ellis Well, Nevada.	Alum Well, Milford.
	<i>Parts in 1,000.<sup>d</sup></i>	<i>Grs. per gall.<sup>e</sup></i>	<i>Grs. per gall.<sup>f</sup></i>	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. per gall.<sup>a</sup></i>
Calcium carbonate	0.173			6.80	
Calcium bicarbonate		14.52			
Magnesium carbonate	0.036			7.76	
Iron carbonate	0.009				
Iron bicarbonate		5.51			
Sodium sulphate		16.22			63.81
Calcium sulphate	0.665	95.78		5.85	43.44
Magnesium sulphate		31.34			66.66
Sodium chloride	6.632			30.19	
Calcium chloride	0.566			9.91	
Potassium chloride	0.085				
Magnesium chloride	0.648			8.62	
Calcium oxide			4.98		
Magnesium oxide			1.80		
Aluminium oxide		0.79	15.08		
Silica	0.008	1.46			
Sulphuric acid			3.60		
Carbonic acid	0.185	15.52	3.92		
Sodium			14.00		
Potassium			1.20		
Iodine			14.00		
Bromine			20.40		
Chlorine					
Organic matter		0.07			
Loss			3.02		
Total	9.007	181.21	72.00	69.13	173.91

<sup>a</sup> Regis Chauvenet, analyst.<sup>b</sup> Paul Schweitzer, analyst.<sup>c</sup> Paul Schweitzer, analyst (1874).<sup>d</sup> Litton, analyst (1853).<sup>e</sup> Paul Schweitzer, analyst (1873).<sup>f</sup> H. W. Wiley, analyst (1882).<sup>g</sup> With iron oxide.

*Analyses of mineral springs in Missouri—Continued.*

Constituents.	Fairview Mineral Spring.	Harriman's Sulphur Spring.	Landreth's Mineral Well.	Sweet Springs near Browns- ville.	
				Akeson Spring.	Sweet Spring.
	<i>Grs. per gall.<sup>a</sup></i>	<i>Parts in 1,000.<sup>b</sup></i>	<i>Grs. per gall.<sup>c</sup></i>	<i>Grs. per gall.<sup>d</sup></i>	<i>Grs. per gall.<sup>d</sup></i>
Calcium carbonate .....		0.122	32.65	40.25	9.56
Calcium bicarbonate .....	14.88				
Magnesium carbonate .....		0.055			
Magnesium bicarbonate .....	16.98				
Iron carbonate .....		0.006	2.39	0.27	0.57
Iron bicarbonate .....	18.73				
Manganese carbonate .....				0.20	Trace
Sodium sulphate .....			30.86	2.61	
Calcium sulphate .....	11.60	1.590	18.41	57.93	9.46
Magnesium sulphate .....			23.54		
Potassium sulphate .....			0.47		
Barium sulphate .....				8.15	
Calcium phosphate .....				0.24	
Magnesium nitrate .....				0.18	
Ammonium nitrate .....				1.17	
Sodium chloride .....	2.64	15.757	1.17	756.11	86.92
Calcium chloride .....		1.326		74.79	14.72
Potassium chloride .....		0.014		28.56	3.40
Magnesium chloride .....		1.403		87.32	22.29
Lithium chloride .....				0.30	0.05
Magnesium bromide .....				0.13	0.12
Aluminium oxide .....			0.67	0.17	0.09
Silica .....		0.010	0.95	0.51	1.08
Carbonic acid .....		0.298	7.56		
Free carbonic acid .....	4.56				
Organic matter .....				3.05	4.01
Total .....	69.39	20.581	118.67	1,061.94	152.27

Constituents.	Mooreaville Mineral Springs.	Lewis Spring.	New Baden Springs.	Prewett's Well.
	<i>Grs. per gall.<sup>e</sup></i>	<i>Grs. per gall.<sup>f</sup></i>	<i>Grs. per gall.<sup>e</sup></i>	<i>Grs. per gall.<sup>f</sup></i>
Calcium carbonate .....		23.71		13.93
Calcium bicarbonate .....	17.61		20.05	
Magnesium carbonate .....		73.12		
Magnesium bicarbonate .....			2.36	
Iron bicarbonate .....	5.07		0.31	
Manganese bicarbonate .....			0.11	
Sodium sulphate .....			7.48	
Calcium sulphate .....	4.66	122.91	28.06	22.28
Magnesium sulphate .....	1.40			20.37
Potassium sulphate .....			1.23	
Aluminium sulphate .....	5.20			
Calcium phosphate .....			0.04	
Sodium chloride .....	2.15	951.30	0.05	7.70
Calcium chloride .....		37.29		
Potassium chloride .....	2.45			
Aluminium oxide .....			0.22	
Silica .....	0.61		1.54	
Free carbonic acid .....			12.75	
Iodine .....	Trace			
Organic matter .....	2.15			
Loss .....	0.22			
Total .....	41.52	1,208.33	74.20	64.28

<sup>a</sup> Lord and Stoutenburg, analysts.<sup>b</sup> Litton, analyst.<sup>c</sup> Paul Schweitzer, analyst.<sup>d</sup> Charles P. Williams.<sup>e</sup> Wright and Merrell, analysts (1831).<sup>f</sup> Regis Chauvenet, analyst.

## Analyses of mineral springs in Missouri—Continued.

Constituents.	Randolph Medical Springs.	Belcher's Artesian Well.	Paris Chalybeate Springs: Williams's Spring.	Montesano Springs.	
				Montesano Spring.	Casco Spring.
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Parts in 1,000.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Calcium carbonate .....		10.63	0.300	71.450	69.970
Magnesium carbonate .....		1.02	0.024	14.050	15.500
Iron carbonate .....	5.13	0.52	0.006		
Sodium sulphate .....			0.065		
Calcium sulphate .....	2.43	45.67	0.355	32.370	33.930
Magnesium sulphate .....			0.037		
Potassium sulphate .....			0.037		
Iron and alumina .....				0.870	0.750
Sodium hyposulphite .....				0.747	0.649
Calcium phosphate .....				Trace	Trace
Sodium sulphide .....				0.339	0.432
Sodium chloride .....	4.01	350.61		365.110	368.210
Calcium chloride .....		27.58			
Potassium chloride .....		9.01		16.370	16.990
Magnesium chloride .....	6.95	38.34	0.023	35.910	34.410
Magnesium bromide .....				Trace	0.107
Magnesium iodide .....				0.852	
Lithia .....	1.43				
Ferrous oxide .....	0.93				
Silica .....		0.14	0.013	0.510	0.670
Carbonic acid .....			0.239		
Total .....	20.88	483.52	1.099	538.578	541.618
<i>Gases.</i>		<i>Cubic inches.</i>		<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbonic acid .....		6.56		46.43	43.20
Sulphureted hydrogen .....		0.24		1.40	1.60

Constituents.	Montesano Springs.			
	Council Spring.	Alton Spring.	Pearl Spring.	Thorn Spring.
	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Magnesium carbonate .....		5.540		
Magnesium bicarbonate .....	3.770			
Calcium carbonate .....		48.100		
Calcium bicarbonate .....	39.720		57.920	62.440
Calcium sulphate .....	31.910	38.980	38.490	34.560
Sodium hyposulphite .....	Trace	Trace	Trace	
Sodium chloride .....	272.150	337.570	362.520	365.520
Potassium chloride .....	11.680	13.050	13.870	15.280
Magnesium chloride .....	30.990	35.490	46.230	47.500
Calcium chloride .....			3.380	7.220
Sodium sulphide .....		1.560		
Sodium bisulphide .....	1.974		1.644	1.736
Magnesium bromide .....	0.347	0.147	0.879	0.409
Magnesium iodide .....	Trace		0.024	0.112
Calcium phosphate .....		Trace	Trace	Trace
Silica .....	0.770	0.710	1.250	0.840
Iron and alumina .....	0.460	0.549	0.370	0.380
Volatile suspended matter .....			2.560	
Mineral suspended matter .....			1.800	
Total .....	393.771	481.687	530.937	535.997
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbonic acid .....	34.30	40.03	44.14	43.24
Sulphureted hydrogen .....	1.43	1.98	1.76	1.59

<sup>a</sup> Paul Schweitzer, analyst.<sup>b</sup> Litton, analyst.<sup>c</sup> Potter and Riggs, analysts.

NEBRASKA.

The data at hand in relation to Nebraska are insufficient for any extended list of its mineral springs or wells. Springs of any kind are of comparatively infrequent occurrence in most portions of the State, and especially so in the western part.

In many places the waters reached by wells are doubtless somewhat mineralized, as in the neighboring State of Kansas and in Dakota. Salt springs are found in the southeastern part of the State and also near the Elkhorn and Loup Rivers. There is a saline artesian well at Lincoln. So far as can be learned, none of the springs or wells is used medicinally at present.

Mineral springs of Nebraska.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Artesian Well, Lincoln, Lancaster County.....	1	.....	.....	.....	.....
Saratoga Sulphur Spring, Saratoga, Holt County....	1	.....	.....	.....	.....
Salt Springs, Lincoln, Lancaster County.....	.....	.....	.....	.....	.....

KANSAS.

Permanent springs of any kind are said to be somewhat infrequent in Kansas. The mineral waters of the State are derived principally from ordinary wells and artesian borings. Salt or brine wells are quite common in certain portions of the State and are extensively used for the production of salt for local use. Chalybeate springs are found in various places, but the mineral waters are mainly saline and sulpho-saline. They have been developed to a certain extent and many of them have considerable local reputation for medicinal effects. Prof. E. H. S. Bailey, writing of the artesian wells of the State, in the Report of the Kansas State Board of Agriculture for the quarter ending December 31, 1885, says that "shallow wells, especially in the eastern part of the State, furnish hard water impregnated with sulphate of lime and carbonates of lime and magnesia; and as the well goes into deeper strata the chlorides increase and the sulphates decrease."

Among the places of resort the Great Spirit Spring, Baxter Medical Springs, and Genda Springs are well known.

The list of springs given here is probably incomplete and will doubtless be considerably enlarged in the future.

*Mineral springs of Kansas.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Alma Salt Well, Alma, Wabaunsee County.	-----	-----	48	-----	-----
Arrington Mineral Springs, Arrington, Atchison County.	3	420	60	Carbonated, saline, chalybeate.	Used commercially and as a resort.
Baxter Medical Springs, Baxter Springs, Cherokee County.	2	450	50	Chalybeate	Do.
Bonner's Springs, Tiblow, Wyandotte County.	20+	-----	-----	Calcic, carbonated.	Resort.
Brom-magnesian Mineral Well, Independence, Montgomery Co.	1	-----	62	-----	-----
Cranmer Springs, Conway Springs, Sumner County.	8	3,000	43½ to 50	-----	-----
Flowing spring, 2 miles southwest of Junction City, Davis County.	-----	-----	-----	-----	-----
Fort Scott Artesian Well, Fort Scott, Bourbon County.	1	416	67½	Sulpho-saline	-----
Genda Springs, Genda Springs, Sumner County.	7	1,500	55 to 61	Saline	Used commercially and as a resort.
Girard Mineral Well, Girard, Crawford County.	-----	-----	-----	do	Local resort.
Great Spirit Spring, Cawker City, Mitchell County.	1	-----	-----	do	Resort.
Haddon Mineral Well, Moss Springs, Davis County.	-----	-----	-----	Saline ?	-----
Henek's Mineral Springs, Arrington, Atchison County. (See Arrington Springs.)	-----	-----	-----	-----	-----
Iola Mineral Well, Iola, Allen County.	1	120	61	Saline	Used as a sanitarium and resort and commercially.
Jordan's Springs, Jordan Springs, Reno County.	24	1,800+	56 to 57	do	Unimproved.
Lee's Springs, 6 miles east of Peabody, Marion County.	4	350	-----	-----	-----
Louisburg Gas Wells, Louisburg, Miami County.	3	-----	-----	-----	-----
Louisville Springs, Louisville, Pottawatomie County.	3	-----	64	Chalybeate	Resort.
Manhattan or Kansas Artesian Mineral Wells, 10 miles from Manhattan, Riley County.	2	800+	56	Saline	Used commercially and as a resort.
Mineral Spring, Atchison, Atchison County.	-----	-----	-----	-----	Has local reputation.
Moodyville Mineral Springs, 4 miles south of Blaine, Pottawatomie County.	-----	-----	-----	Alkaline, &c	Resort.
Mound Valley Spring, Mound Valley, Labette County.	1	-----	-----	-----	-----
Murphy's Seven Springs, 7 miles from Junction City, Davis County.	7	-----	-----	Alkaline, calcic.	-----
Pfister's Mineral Spring, 6 miles from Junction City, Davis Co.	-----	-----	-----	-----	-----
Piqua Mineral Wells, Piqua, Woodson County.	3	-----	-----	-----	-----
<i>Salt springs:</i>	-----	-----	-----	-----	-----
In northeast part of Stafford County.	-----	-----	-----	-----	-----
In sections 14 and 15, township 8, range 7 west, Mitchell Co.	10+	100	-----	-----	-----
<i>Sulphur springs:</i>	-----	-----	-----	-----	-----
In section 35, township 7, range 2 west, Cloud County.	6	360+	47	Calcic	Unimproved.
In Allen County	-----	-----	-----	-----	-----
Tar Springs, near Somerset, Miami County.	6+	-----	-----	-----	Used to limited extent as resort.
Wyandotte Gas Wells, Wyandotte, Wyandotte County.	6	-----	-----	-----	-----

*Analyses of mineral springs in Kansas.*

Constituents.	Iola Mineral Well.	Fort Scott Artesian Well.	Manhattan Artesian Mineral Wells.		Baxter Medical Springs.	Murphy's Seven Springs.
			Well No. 1.	Well No. 2.		
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>e</sup></i>
Calcium carbonate.....					8.89	
Calcium bicarbonate.....	60.89	14.23	5.28	6.07		13.128
Magnesium carbonate.....					0.12	
Magnesium bicarbonate...	31.94	0.31				5.235
Lithium carbonate.....					0.40	
Iron carbonate.....					5.37	
Iron bicarbonate.....	3.93	1.00	0.19	0.25		
Sodium bicarbonate.....						3.470
Sodium sulphate.....		Trace				
Calcium sulphate.....		0.83	33.37	14.69	3.86	
Magnesium sulphate.....			5.66	6.58	0.68	
Sodium chloride.....	980.50	79.47	0.52	0.86	0.20	
Magnesium chloride.....		7.99				
Calcium chloride.....		0.79				
Potassium chloride.....	17.91	Trace			0.11	
Lithium chloride.....		Trace				
Sodium biborate.....		2.20				
Silica.....	0.60	0.95	10.10	1.19	2.30	0.980
Organic matter.....	2.00	1.17				
Organic matter volatile and loss.					1.70	
Suspended matter.....	2.50					
Iodides.....	Traces					
Bromides.....	Traces					
Sodium hydrosulphide.....		0.19				
Potassium.....			Trace	Trace		
Sulphuric acid.....			61.36	33.11		
Chlorine.....			1.46	1.80		
Alumina and iron.....						Trace
Bromine.....			Trace			
Lithium.....			Trace			
Total.....	1, 100.27	109.13	117.94	64.55	23.63	22.813
<i>Gases.</i>						
Carbonic acid.....	<i>Cub. inches.</i> 145.892				<i>Cub. inches.</i> 38.00	
Sulphureted hydrogen.....		Trace Trace				

<sup>a</sup> W. K. Kedzie, analyst (1876).<sup>b</sup> E. H. S. Bailey and E. W. Walter, analysts (1884).<sup>c</sup> G. H. Failyer, analyst.<sup>d</sup> A. Merrill, analyst (1882).<sup>e</sup> Barnes and Sim, analysts.<sup>f</sup> With calcium chloride.

*Analyses of mineral springs in Kansas—Continued.*

Constituents.	Sulphur Springs, Cloud County.	Girard Min- eral Well.	Henek's Mineral Springs.		Arrington Mineral Springs.
			No. 1.	No. 2.	
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per imp. gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.</i>
Sodium carbonate .....		10.528	11.456	3.551	5.326
Calcium carbonate .....			9.763	6.612	
Calcium bicarbonate .....	16.038	30.033			
Magnesium carbonate .....			5.928	3.257	3.566
Magnesium bicarbonate .....		17.360			
Potassium carbonate .....			1.435		
Iron carbonate .....			3.566	2.007	7.033
Lithium carbonate .....			0.416		
Iron protocarbonate .....		1.197			
Sodium sulphate .....		6.673	2.037		
Calcium sulphate .....	9.683		1.218		0.308
Magnesium sulphate .....	1.920		1.867		12.738
Potassium sulphate .....		1.031			
Sodium chloride .....		95.706	3.628	2.161	2.000
Magnesium chloride .....					1.110
Potassium iodide .....					Trace
Silica .....		1.190	0.987	0.555	0.540
Sulphuric acid .....	18.413				
Sodium .....	Trace				
Iron .....	Trace				
Ammonium crenate .....			0.818	Trace	
Lithia .....					Trace
Baregine .....					Trace
Organic matter .....			0.269	0.910	
Total .....	46.054	163.718	43.388	19.053	32.621
<i>Gas.</i>					
Carbonic acid .....			<i>Cubic inches.</i> 42.00	<i>Cubic inches.</i> 39.30	<i>Cubic inches.</i> 94.30

Constituents.	Brom- magne- sian Min- eral Well.	Bonner's Springs.					
		No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
	<i>Grs. per gallon.<sup>a</sup></i>	<i>Grs. per gallon.<sup>c</sup></i>	<i>Grs. per gallon.<sup>c</sup></i>	<i>Grs. per gallon.<sup>c</sup></i>	<i>Grs. per gallon.<sup>c</sup></i>	<i>Grs. per gallon.<sup>c</sup></i>	<i>Grs. per gallon.<sup>c</sup></i>
Sodium carbonate .....				66.481			
Calcium carbonate .....		11.248	13.424	7.028	11.674	13.392	7.968
Calcium bicarbonate .....	30.537						
Magnesium carbonate .....		5.472	Trace	7.482	1.961	2.335	5.846
Iron carbonate .....		1.371	0.141		6.594	4.947	5.771
Iron bicarbonate .....	1.682						
Calcium sulphate .....	9.047	2.608		Trace		0.344	0.604
Potassium sulphate .....	13.771						
Sodium chloride .....	3,466.921			12.768			
Magnesium chloride .....	347.770						
Calcium chloride .....	419.140	0.750	1.040		Trace	Trace	Trace
Sodium bromide .....	13.711						
Sodium iodide .....	0.092						
Phosphoric acid .....		Trace	Trace	Trace	Trace	Trace	Trace
Silica .....	1.155	0.495	0.360				
Alumina .....	Trace						
Organic matter .....	Trace	Sm'l am't	Sm'l am't	Sm'l am't	Trace		Sm'l am't
Total .....	4,303.826	21.944	14.985	93.759	20.229	21.018	20.189
<i>Gas.</i>							
Carbonic acid .....		<i>Cub. in.</i> 25.660	<i>Cub. in.</i> 16.190	<i>Cub. in.</i> 21.716	<i>Cubic in.</i> 19.032	<i>Cubic in.</i> 20.059	<i>Cubic in.</i> 18.422

<sup>a</sup> G. H. Failyer, analyst.<sup>c</sup> Juan H. Wright, analyst (1882).<sup>c</sup> William Jones, analyst (1884).<sup>b</sup> C. G. Gilbert, analyst.<sup>d</sup> E. H. S. Bailey, analyst.

Analyses of mineral springs in Kansas—Continued.

Constituents.	Great Spirit Spring.	Flowing Spring.	Pfister's Spring.	Piqua Artesian Well.	Wyandotte Gas Wells.	Haddon Mineral Well.
	<i>Grs. per gallon.<sup>a</sup></i>	<i>Grs. per gallon.<sup>b</sup></i>	<i>Grs. per gallon.<sup>b</sup></i>	<i>Grs. per gallon.<sup>c</sup></i>	<i>Grs. per gallon.<sup>d</sup></i>	<i>Grs. per gallon.<sup>e</sup></i>
Sodium carbonate.....	.....	3. 29	.....	.....	.....	.....
Sodium bicarbonate.....	26. 924	.....	.....	2. 149	.....	.....
Calcium carbonate.....	.....	17. 26	1. 68	.....	13. 659	.....
Calcium bicarbonate.....	.....	.....	.....	40. 738	.....	7. 7605
Magnesium carbonate.....	.....	5. 48	.....	.....	86. 661	.....
Magnesium bicarbonate.....	.....	.....	.....	33. 484	.....	0. 4465
Iron carbonate.....	.....	1. 65	.....	.....	1. 400	.....
Iron bicarbonate.....	.....	.....	.....	Trace	.....	0. 1946
Sodium sulphate.....	183. 600	.....	92. 40	.....	.....	.....
Magnesium sulphate.....	85. 281	.....	58. 24	6. 000	.....	.....
Calcium sulphate.....	.....	.....	44. 80	.....	0. 525	.....
Sodium chloride.....	765. 767	.....	119. 28	670. 805	1, 502. 320	.....
Calcium chloride.....	.....	Trace	.....	.....	56. 103	.....
Potassium chloride.....	.....	.....	.....	18. 912	.....	.....
Calcium oxide.....	.....	.....	.....	.....	.....	8. 6739
Magnesium oxide.....	.....	.....	.....	.....	.....	9. 7205
Sodium bromide.....	0. 234	.....	.....	.....	.....	.....
Hydrogen sulphide (combined).....	.....	.....	.....	.....	.....	0. 4967
Hydrogen sulphide (free).....	.....	.....	.....	.....	.....	1. 9620
Silicious matter.....	.....	0. 95	6. 72	.....	.....	.....
Carbonic acid (combined).....	.....	.....	.....	.....	.....	6. 5886
Silicic acid.....	Trace	.....	.....	.....	.....	.....
Nitrous acid.....	{ Minute trace }	.....	.....	.....	.....	.....
Boric acid.....	.....	.....	.....	.....	.....	Trace
Sulphuric acid.....	.....	.....	.....	.....	.....	37. 4683
Phosphoric acid.....	.....	.....	.....	.....	.....	Trace
Magnesium.....	27. 561	.....	.....	.....	.....	.....
Calcium.....	31. 398	.....	.....	.....	.....	.....
Alumina.....	.....	0. 21	1. 12	.....	.....	1. 4083
Sodium.....	.....	.....	.....	.....	.....	3. 1017
Silica.....	.....	.....	.....	Trace	0. 566	0. 8774
Iodine.....	.....	.....	.....	.....	.....	Trace
Lithia.....	.....	.....	.....	.....	.....	Trace
Chlorine.....	.....	.....	.....	.....	.....	0. 8047
Organic matter.....	.....	.....	.....	.....	13. 250	.....
Total.....	1, 120. 765	28. 84	324. 24	772. 088	1, 674. 484	79. 5037
Gas.....	<i>Cubic in.</i>	.....	.....	.....	.....	.....
Carbonic acid.....	91. 00	.....	.....	Abund't	.....	.....

<sup>a</sup> G. E. Patrick, analyst (1880).

<sup>b</sup> Barnes and Sim, analysts (1883).

<sup>c</sup> E. H. S. Bailey, analyst.

<sup>d</sup> E. C. Franklin, analyst (1885).

<sup>e</sup> G. H. Failyer, analyst.

WESTERN STATES AND TERRITORIES.

The first thing to attract attention, in a general survey of the mineral springs of the West, is the far greater prevalence of thermal springs in them when compared with other sections. The Western States, as already defined, contain only a little over 39 per cent. of the total area of the country, and yet within their limits are found more than 80 per cent. of its known thermal springs. This proportion is likely to be increased, as the Western States present the best field for future discoveries. When we consider the individual springs, even manifestly imperfect as are our lists in respect to the total number, the contrast appears even greater. Not only is the number of hot and warm springs greatly in excess of that in other portions of the country, but the thermal phenomena are overwhelmingly greater in intensity. In no other section are there any manifestations equal to those exhibited by the geysers of the Yellowstone National Park.

Mr. G. K. Gilbert<sup>1</sup> has called attention to the fact that the geological relations appear to accord with this hydro-thermal contrast between the Western States and the other divisions of the country. He refers the greater heat in the former to local uprisings of the geiso-thermal planes, together with progressive corrugation, the intensity of the phenomena being heightened by the intrusion and extrusion of lavas.

The connection of hot and warm springs with volcanic rocks, with uplifted mountain chains, and with dislocations or fractures of strata has long been recognized. Our Western States present all these conditions. Here are the most elevated portions of our country and with the upward movement still in progress. A single glance at the general geologic map of the United States suffices to show that in this portion of our domain evidences exist of most intense volcanic activity, both past and present.

The Western States have been subdivided into four divisions, viz, the Rocky Mountain region, the Plateau region, the Great Basin, and the Pacific Coast. In the Rocky Mountain States, mountain corrugation is probably the primary cause of the hot springs found, although igneous areas are not wanting, as notably in the case of the Yellowstone National Park, in Wyoming. In the Pacific Coast region the uplifts of the Sierras and Coast Ranges are accompanied by igneous rocks, and as we proceed northward, volcanic outbursts form a striking feature. Almost all the springs on our Alaska list are warm or hot and in Alaska we find the volcanic forces still active.

In the Great Basin, mountain corrugation is subordinate to the faulting of the strata as a cause of hot and warm springs. Mr. I. C. Russell describes this region as follows:<sup>2</sup>

"The whole immense region lying between the Sierra Nevada and Rocky Mountain systems has been broken by a multitude of fractures, having an approximately north and south trend, that divide the region into long, narrow, orographic blocks."

With these profound faults hot springs are associated, and a map of the hot springs of the Great Basin would be, to a great extent, also a map of the lines of displacement. With these displacements also are associated volcanic rocks. In the plateau region again we find a similar association of faulted strata and the former outpouring of igneous rocks.

Although thermal springs are so characteristic of the Western States, other classes are not wanting. Alkaline, saline, chalybeate, and calcic springs are numerous; many of them are carbonated and still more are sulphureted. Silicious springs, not prominent in other sections, are found abundantly in the areas of hot springs.

<sup>1</sup> Report of the United States Geographical Surveys West of the 100th Meridian, Vol III, pp. 147-149.

<sup>2</sup> Fourth Annual Report of the United States Geological Survey, 1882-'83, p. 443.

The Western States having been more recently settled, we find that fewer springs have been improved and developed than in the east. Still the number of resorts is fairly large, and more waters are used commercially than would be expected in view of the newness of the country.

The number of analyses that have been made is, however, still comparatively small.

*Summary for the Western States and Territories.*

States.	Number of spring localities.	Number of individual springs.	Number of springs analyzed.	Number of springs utilized as resorts.	Number of springs used commercially.	Total number of analyses.
Montana.....	42	200	8	8	0	8
Idaho.....	32	114	2	4	0	2
Wyoming.....	41	2,246	7	3	0	7
Utah.....	48	144	6	5	0	9
Colorado.....	70	359	37	16	1	38
New Mexico.....	36	126	12	5	2	12
Arizona.....	26	30	3	1	0	3
Nevada.....	120	179	4	10	0	6
California.....	220	435	44	42	11	44
Oregon.....	47	72	8	16	3	8
Washington.....	15	19	1	2	1	1
Alaska.....	25	25	0	0	0	0
Total.....	722	3,949	132	112	18	138

MONTANA.

The Territory of Montana possesses many important and interesting mineral springs, although little has ever been published in relation to them, especially in general works on the subject. This is due partly to two causes: Montana was until recently so isolated that comparatively little was known of the Territory. Again, the proximity of the Yellowstone National Park and the fact that the readiest access to it is through Montana have attracted more attention to the wonderful phenomena of the geyser regions, and they have overshadowed the lesser springs. The majority of the springs are thermal, and they are found mainly in the western and more mountainous portions of the Territory. They are sulphureted, carbonated, alkaline, saline, chalybeate, and calcic. Among the carbonated springs is one closely resembling the celebrated Apollinaris spring of Prussia. Very few analyses have been made, and the character of more than half the springs is unknown. A number of localities have been improved and several are well known for the curative effects of their waters. Among the latter are the White Sulphur Springs, Hunter's Hot Springs, Matthews Warm Springs, and the Helena Hot Springs. The Territorial Asylum for the Insane is located at Warm Springs, in Deer Lodge County. The present table is derived from the personal knowledge of the writer, with data from various persons well known in Montana. Thanks are especially due to Mr. Peter Koch, of Bozeman, and Mr. Walter Matheson, of Billings, for information furnished.

*Mineral springs of Montana.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Alhambra Springs, Clancy, Jefferson County.	.....	.....	Hot	.....	Resort.
Allan's Mineral Springs, Pine Creek, } Bitter Root Valley, Missoula Co. }	16	500	{114 to 121}	.....	Local resort.
Alum Spring, Upper Emigrant Gulch, Gallatin County.	1	.....	.....	.....	Unimproved.
Bedford Warm Springs, Bedford, Jefferson County.	.....	.....	.....	.....	Do.
Big Hole Hot Spring, Big Hole Prairie, Beaver Head County.	100	.....	132	Calcareous.....	Do.
Boulder Hot Spring, 2 miles from Boulder Valley, Jefferson County.	.....	.....	.....	.....	Local resort.
Bridger Cañon Tepid Spring, near Bozeman, Gallatin County.	1	.....	80	.....	Unimproved.
Chalybeate Spring, in Upper Emigrant Gulch, Gallatin County.	.....	.....	.....	.....	.....
Clark's Warm Springs, near Pony, } Madison County.	8	2,000+	{50 to 120}	.....	{ Unimproved but used locally.
Emigrant Gulch Warm Spring, on Emigrant Creek, Yellowstone Valley, Gallatin County.	1	14,400	102	Alkaline, calcic.	Used locally.
Grayson's Hot Springs, head of Deer Lodge Valley, Deer Lodge County.	.....	.....	.....	.....	.....
Hapgood Hot Springs, near Red Bluff, Madison County.	5	.....	.....	.....	Unimproved.
Helena Hot Springs, near Helena, } Lewis and Clarke County.	2	.....	{122 to 141}	Alkaline, saline.	Improved.
<i>Hot springs:</i> On North Fork of Sun River, Lewis and Clarke county.	.....	.....	.....	Sulphureted, chalybeate.	Unimproved.
Eighteen miles east of White Sulphur Springs, Meagher County.	.....	.....	.....	.....	.....
On Hellgate River, near Bear's Mouth, Deer Lodge County.	.....	.....	.....	.....	.....
Southwest of Flathead Lake and 14 miles northeast of Horse Plains, Missoula County.	.....	.....	.....	.....	.....
On Granite Fork of Lou-Lou Fork, Missoula County.	.....	.....	.....	.....	.....
Hunter's Hot Springs, Yellowstone Valley, Gallatin County.	12	105,000	{122 to 141}	Alkaline.....	Improved as a resort.
Livingston Warm Springs, near Livingston, Gallatin County.	12	24,000	104	Calcic, sulphureted.	Unimproved.
Lou-Lou Fork Hot Springs, on Lou-Lou Fork, Missoula County.	.....	35,000	{98? to 132}	{ Chalybeate, sulphureted.	.....
Matthews Warm Springs, 7 miles west of Bozeman, Gallatin County.	2	.....	{114 to 122}	Alkaline, saline.	Improved.
Medicine Creek Hot Springs, on Weeping Child Fork of Bitter Root, Missoula County.	.....	.....	.....	.....	Used locally.
Miles City Artesian Well, Miles City, Custer County.	.....	.....	.....	Alkaline.....	.....
Mill Creek Apollinaris Spring, Mill Creek, Yellowstone Valley, Gallatin County.	.....	.....	40	Carbonated.....	Unimproved.
<i>Mineral springs:</i> One mile north of Puller Springs, Madison County.	.....	.....	.....	.....	Do.
West Fork of Bitter Root River, Missoula County.	.....	.....	.....	Carbonated.....	Do.
Nave's Warm Spring, on Crow Creek, Jefferson County.	.....	.....	.....	.....	Do.
Pipestone Springs, near Pipestone, Jefferson County.	.....	.....	.....	.....	.....

*Mineral springs of Montana—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Puller's Springs, Puller Springs, on Upper Ruby Creek, Madison County.	} 2	.....	° {102 to {110}	.....	Resort.
Ross's Hole Hot Springs, near head of Bitter Root River, Missoula County.			.....	.....	Unimproved.
Ryan's Hot Springs, Ryan's Cañon, near Dillon, Beaver Head County.	.....	1,400	120	.....	.....
<i>Sulphur springs:</i>	.....	.....	.....	.....	.....
On Deep Creek, between Townsend and White Sulphur Springs, Meagher County.	.....	.....	Cold.	.....	Do.
On Rock Creek, northwest of Camp Baker, Meagher County.	.....	.....	.....	.....	.....
Near Great Falls of Missouri, Choteau County.	.....	.....	.....	.....	.....
<i>Thermal springs:</i>	.....	.....	.....	.....	.....
On Warm Springs Creek, near McCasin Mountain, Meagher Co.	.....	.....	.....	.....	Unimportant.
At head of Big Spring Creek, Meagher County.	.....	.....	.....	.....	.....
Warm Springs, Warm Springs, Deer Lodge Valley, Deer Lodge County.	.....	.....	.....	.....	.....
<i>Warm springs:</i>	.....	.....	.....	.....	.....
On Warm Springs Creek, near Garrison, Deer Lodge County.	.....	.....	.....	.....	.....
Wasswieler's Warm Springs, near Helena, on Ten-Mile Creek, Lewis and Clarke County.	.....	.....	.....	.....	.....
Werner's Warm Springs, on branch of Crow Creek, Jefferson County.	.....	.....	.....	.....	.....
White Sulphur Springs, White Sulphur Springs, Meagher County.	9+	13,000+	123½	Alkaline and saline, sulphureted.	Resort.

*Analyses of mineral springs in Montana.*

Constituents.	Livingston Warm Springs.	Emigrant Gulch Warm Springs.	Helena Hot Springs.	Mill Creek Apollinaris Spring.
	<i>Gram per liter.<sup>a</sup></i>	<i>Gram per liter.<sup>a</sup></i>	<i>Gram per liter.<sup>a</sup></i>	<i>Gram per liter.<sup>a</sup></i>
Sodium carbonate.....	0.0461	0.0274	0.1730	0.9853
Calcium carbonate.....	0.1880	0.0865	0.0268	0.9270
Magnesium carbonate.....	0.1533	0.0269	.....	0.2838
Sodium sulphate.....	.....	0.0487	0.2742	0.9402
Calcium sulphate.....	0.3150	.....	.....	0.0204
Sodium chloride.....	0.0143	0.0058	0.0596	0.3795
Potassium chloride.....	0.0078	0.0083	.....	0.0981
Silica.....	0.0290	0.0317	0.0938	0.0250
Potassium.....	.....	.....	Trace	.....
Lithia.....	.....	.....	Trace	Trace
Iodine.....	.....	.....	.....	Trace
Iron and aluminium oxide.....	.....	.....	.....	0.0876
Loss.....	0.0040	.....	.....	0.0656
Total.....	0.7575	0.2353	0.6274	3.8125

Constituents.	Hunter's Hot Springs.	Miles City Artesian Well.	White Sul- phur Springs, Spring No. 2.	Matthews Warm Springs.
	<i>Parts in 100,000.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Gram per liter.<sup>d</sup></i>	<i>Gram per liter.<sup>d</sup></i>
Sodium carbonate.....	15.05	60.40	0.5571	0.0750
Calcium carbonate.....	0.40	2.27	0.1280	0.0390
Potassium carbonate.....	0.55	.....	.....	.....
Magnesium carbonate.....	Trace	.....	0.0438	0.0036
Iron carbonate.....	Trace	.....	.....	.....
Lithium carbonate.....	Trace	.....	.....	.....
Sodium sulphate.....	1.04	1.80	0.4463	0.1974
Sodium chloride.....	2.47	2.01	0.2460	0.0707
Potassium chloride.....	.....	.....	0.0807	0.0134
Silica.....	7.74	1.36	0.0330	0.0826
Free ammonia.....	0.43	.....	.....	.....
Albuminoid ammonia.....	0.05	.....	.....	.....
Iron oxide.....	.....	0.54	.....	.....
Magnesia.....	.....	0.83	.....	.....
Potassium iodide.....	Trace	.....	.....	.....
Potassium bromide.....	Trace	.....	.....	.....
Sodium phosphate.....	Trace	.....	.....	.....
Sodium bichlorate.....	Trace	.....	.....	.....
Loss.....	.....	.....	.....	0.0010
Aluminium.....	0.12	.....	.....	.....
Sodium silicate.....	.....	.....	0.0194	0.1098
Sodium-sulphide.....	1.46	.....	.....	.....
Hydrogen sulphide.....	.....	.....	Trace	.....
Total.....	29.31	69.21	1.5543	0.5925

<sup>a</sup>F. W. Clarke, analyst (1884).<sup>b</sup>W. A. Noyes, analyst.<sup>c</sup>J. M. Wing & Co., analysts (1884).<sup>d</sup>R. B. Riggs, analyst (1885).

IDAHO.

The chemical composition of the mineral springs of Idaho is so little known that they cannot be definitely classified beyond stating that thermal springs predominate. That warm and hot springs abound might naturally be expected, when the geological structure of the Territory is recalled. Granitic and volcanic rocks prevail, and, in connection with the mountain corrugation, present most favorable conditions for the development of hot and warm springs. Mr. G. F. Becker, in the Statistics and Technology of the Precious Metals (p. 53), 1885, speaking of Idaho, says that hot springs are thickly distributed through the granitic areas, and in many cases issue directly through the granite, although usually within a mile or two of the known volcanic rocks, and that many of them are highly charged with alkalis and hydrogen sulphide. The list presented here has been made up largely from various maps. Mr. Albert Williams has also kindly given considerable information. Although few of the springs have been improved, a great many are used extensively for bathing, especially in the mining regions. The most widely known resort is at Soda Springs, near the bend of Bear River. None of the waters is at present used commercially.

Mineral springs of Idaho.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Bruneau Hot Spring, Bruneau Valley, Owyhee County.	1	70,000	105	.....	Used for bathing resort.
Chalybeate Spring, near Spring Creek, of Henry's Fork, Oneida County.	1	.....	Cold.	.....	
Given's Hot Springs, Snake River, near Reynolds, Owyhee County.	2	2,000	98	.....	Unimproved, but used to small extent locally for bathing.
Hot Creek, Idaho County, 20 miles northwest of Bonanza.	.....	.....	.....	.....	
Hot Creek, south of Snake River, 4 or 5 miles below American Falls, Oneida County.	.....	.....	.....	.....	
Hot lakes, 20 miles south of Washington, Idaho County.	.....	.....	.....	.....	
Hot springs:					
Five miles east of Boise City, Ada County.	} 16	15,400	{ 90 to 212	Chalybeate, alkaline, sulphureted, &c.	} Improved and used as a resort. Unimproved.
North of Fishing Falls, Alturas County, about 60 miles southeast of Boise City, 25 miles north of Snake River.			164	Chalybeate	
Fifteen miles west of Ketchum, Alturas County.	.....	.....	.....	.....	
Near Duck River, about 15 miles south of Hailey, Alturas County.	.....	.....	.....	.....	
Three miles southwest of Idaho City, Boise County.	6	5,000	115	Sulphureted	Used locally.
On Salmon River, 15 miles south of Bonanza, Custer County.	.....	.....	.....	.....	
East side of Bear River, at south end of Gentile Valley, Oneida Co.	.....	.....	125	.....	Unimproved.
On South Fork of Snake River, 8 miles below Salt River, Oneida County.	} 6	.....	{ 88 to 144	Saline and sulphureted.	} Do.

*Mineral springs of Idaho—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Hot springs—Continued.</i>			°		
On South Fork of Snake River, below the lower cañon, Oneida Co.	1	.....	.....	.....	Unimproved.
Lincoln Valley Warm Springs, 3 miles southeast of Fort Hall, Oneida Co.	5	.....	{ 69 to 87 }	Calcareous.....	Do.
<i>Mineral springs:</i>					
On Rapid River, Idaho County, 40 miles northwest of Bonanza.	.....	.....	.....	.....	.....
At Waha, Nez Percés County.....	10	.....	.....	.....	.....
Robinson's Mineral Springs, Owyhee County.	.....	.....	.....	.....	.....
Soda Springs, at bend of Bear River, Oneida County.	40	.....	{ 52 to 88 }	Carbonated, calcareous, and chalybeate.	Improved as resort.
Twin or Soda Springs, east side of Portneuf Valley, Oneida County.	.....	.....	.....	.....	Unimproved.
Warm Creek, south of Salmon River, 20 miles south of Bonanza, Custer Co.	.....	.....	.....	.....	.....
<i>Warm spring creeks:</i>					
Southwest of Ketchum, Alturas Co.	.....	.....	.....	.....	.....
Fifteen miles northeast of Banner, Boise County.	.....	.....	.....	.....	.....
Six miles east of Challis, Custer Co.	.....	.....	.....	.....	.....
<i>Warm springs:</i>					
Near Munday's Ferry, on Snake River, Ada County.	.....	.....	.....	.....	.....
Southeast of Lemhi Agency, Lemhi County.	.....	.....	.....	.....	.....
Two miles north of Samaria, Oneida County.	1	.....	85	.....	.....
Seven miles south or southeast of Samaria, Oneida County.	.....	.....	.....	.....	.....
West side of Bear River, south end of Gentile Valley, Oneida Co.	5	.....	.....	Calcareous and chalybeate.	.....
On Lander road, northeast end of Upper Portneuf Valley, Oneida County.	.....	.....	.....	.....	.....
Warm Sulphur Springs, near Lincoln Lake, 13 miles south of Washington, Idaho County.	.....	.....	.....	Sulphureted....	.....

*Analyses of mineral springs in Idaho.*

These analyses are taken from Frémont's Report on an Exploration of the Country Lying Between the Missouri River and the Rocky Mountains, &c, Washington, 1843.

Constituents.	Soda Springs of Bear River, Beer Spring.	Deposit from Hot Springs, north of Fishing Falls.
	<i>Grs. per gall.</i>	<i>Per cent.</i>
Magnesium sulphate .....	48.40	.....
Calcium sulphate.....	8.48	.....
Calcium carbonate.....	15.44	14.60
Magnesium carbonate.....	12.88	1.20
Calcium chloride.....	5.32	.....
Magnesium chloride.....	4.48	.....
Sodium sulphate.....	.....	.....
Sodium chloride.....	8.96	1.10
Water and loss.....	.....	.....
Vegetable extractive matter.....	3.40	5.20
Silica.....	.....	72.55
Alumina.....	.....	0.70
Iron oxide.....	.....	4.65
Total .....	107.36	100.00

\* With calcium sulphate.

## WYOMING.

The Yellowstone National Park, with its wonderful geysers and large number of hot springs, lies almost entirely within the borders of Wyoming Territory. In the table the Park is divided into thirteen sublocalities, containing altogether more than two thousand springs. Besides these, our list includes twenty-eight localities outside of the Park. It is probably not complete, for there are large portions of the Territory still but little known. This is especially true of the region of the Big Horn Mountains. The table has been compiled from various Government maps and reports. Several places are utilized as resorts, and the water from a spring at Soda Butte in the National Park is sometimes offered for sale in Montana.

*Mineral springs of Wyoming.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Alkali lakes, on branches of Lost Creek, south of Sweetwater Mountains, Sweetwater County.			o		
Calcareous Springs, Green River, 10 miles south of the Upper Bend, Uinta County.					
<i>Chalybeate springs:</i>					
Three miles northwest of Point of Rocks, Sweetwater County.					
Near Meeteetse, south of Grey Bull River, Frémont County.			50		
<i>Hot springs:</i>					
On Beaver Creek, northwest of Rongis, Frémont County.			96		
At Hot Spring gate on North Platte River, Carbon County.					
On Big Horn River, Sweetwater or Johnson County.					
Two miles from Camp Brown, Frémont County.			110.3		
On Snake River, 4 or 5 miles below Hoback's River, Uinta (?) County.			117	Calcic	
<i>Hot sulphur springs:</i>					
On Stinking Water River, 20 miles east of Heart Mountains, Sweetwater County.					
On west side of Salt River, 5 miles northeast of Oneida Salt Works, Uinta (?) County.					
Le Roy Springs, near Le Roy Station, Uinta County.	12			Carbonated, saline.	Used locally.
Saratoga Springs, Saratoga, Carbon County.	6	600	120	Saline, chalybeate.	Resort.
Soda Lakes, along Sweetwater River, Carbon and Sweetwater (?) Counties.					
<i>Sulphur springs:</i>					
On Sulphur Creek, near Hilliard, Uinta County.					
On Hoback's River, 5 miles above mouth, Uinta (?) County.			47		
Near junction of North and South Forks of Stinking Water River, Sweetwater (?) County.			56		
Four or 5 miles east of North and South Forks of Stinking Water River, Sweetwater County.					
Six miles west of Camp Brown, Frémont County.			50		

*Mineral springs of Wyoming—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Sulphur springs—Continued.</i>					
East of Point of Rocks, Sweet-water County.	.....	.....	.....	.....	.....
East of Rock Springs, Sweet-water County.	.....	.....	.....	.....	.....
Near Rawlins, Carbon County.	.....	.....	.....	.....	.....
At Sulphur, south of Separation, near Bridger Pass, Carbon Co.	7	.....	.....	.....	Unimproved.
Sulphur and chalybeate springs, valley of Medicine Bow River, Carbon County.	.....	.....	.....	.....	.....
<i>Warm springs:</i>					
Northwest of Fort Laramie, Laramie County.	1	.....	74	.....	.....
Fifteen miles north of Independence Rock, on Horse Creek, Carbon County.	.....	.....	.....	.....	.....
Wind River, below Warm Spring Creek, Fremont (?) County.	.....	.....	84	.....	.....
Mouth of Jake's Creek Cañon, near Wind River, Fremont (?) County.	.....	.....	68	.....	.....
<i>Yellowstone National Park springs:</i>					
Mammoth Hot Springs	78	.....	63 to 165	Saline, calcic	Improved for a resort.
Yellowstone River Springs	47	.....	127 to 196	Sulphureted, acid, and silicious.	
Hayden's Valley Springs	128	.....	190 to 197	do	Accommodations for tourists. Do.
Yellowstone Lake Springs	112	.....	190 to 192	Silicious and sulphureted.	
Pelican Creek Springs	11	.....	160	Sulphureted, &c.	
Gibbon River Springs	121	.....	90 to 197	Silicious, &c.	
Lower Geyser Basin	693	.....	180 to 201	do	
Upper Geyser Basin	440	.....	190 to 200	do	
Third Geyser Basin	20	.....	185 to 192	do	
Shoshone Geyser Basin	356	.....	192 to 201	do	
Heart Lake Geyser and Basin	149	.....	175 to 198	do	
Lewis Lake and Snake River	40	.....	112 to 174	do	
Sulphur Springs on Cascade Creek	.....	.....	.....	Sulphureted	.....

*Analyses of mineral springs in Wyoming.*

Constituents.	Yellowstone National Park Springs.						Le Roy Springs.
	Mammoth Hot Springs.		Lower Geyser Basin, Jug Spring.	Gibbon Geyser Basin.			
	Cleopatra Spring.	Spring No. 17.		Echinus Geyser.	Pearl Geyser.	Opal Spring.	
	<i>Grs. per imp. gall.*</i>	<i>Grs. per imp. gall.*</i>	<i>Grs. per imp. gall.*</i>	<i>Grs. per imp. gall.*</i>	<i>Grs. per imp. gall.*</i>	<i>Grs. per imp. gall.*</i>	<i>Grains per gall.</i>
Sodium carbonate.....		17.92	50.75				
Calcium carbonate.....	24.85	.....	.....				<sup>b</sup> 100.00
Magnesium carbonate.....	7.45	2.17	.....				51.00
Sodium sulphate.....	35.50	34.37	.....	11.59	1.89	.....	117.00
Calcium sulphate.....	13.59	.....	2.03	.....	1.40	3.22	.....
Sodium chloride.....	13.50	18.90	31.57	13.65	61.39	82.18	270.00
Calcium chloride.....	.....	.....	.....	.....	.....	4.06	.....
Silica.....	3.50	3.36	14.56	16.19	7.84	53.76	.....
Sodium orthosilicate.....	.....	.....	.....	10.58	.....	.....	.....
Total.....	98.39	70.72	98.91	52.01	72.52	143.22	538.00

\* Henry Leffmann, analyst (1832).

\* With calcium sulphate.

UTAH.

The earlier explorers and travelers who crossed Utah on their way to the Pacific noted the presence of mineral waters and thermal springs, especially in the region of Great Salt Lake. These springs, some of them strongly saline, in many places furnish all the water to be obtained, except by long journeys. The thermal springs occur mainly in connection with faulted strata, and they also are generally saline and frequently sulphureted. Comparatively few are used as resorts, even locally, and none of the waters is known to be at present of commercial importance. The springs at Salt Lake City are probably the best known and most used for medicinal purposes. The "Utah Hot Springs," ten miles north of Ogden, formerly called "Red Springs" and "Bear River Springs," are used for bathing to a considerable extent. There is a hotel at the springs, and the place is utilized largely by residents of Ogden. "Beck's Hot Springs" are probably the springs 2 or 2½ miles north of Salt Lake City and the same as the springs analyzed by Jackson in 1850 and Gale in 1851. For a considerable number of localities and corrections of temperatures I am indebted to Mr. G. K. Gilbert.

Mineral springs of Utah.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Beck's Hot Springs, near Salt Lake City, Salt Lake County.	.....	.....	o	.....	Bathing resort.
Blue Springs, 18 miles southeast of Snowville, Box Elder County.	6	.....	86	Alkaline .....	Unimproved.
Carbonated Spring, 2 miles southwest of Draper, Salt Lake County.	1	.....	Warm	Calcic, carbonated.	.....
Fish Springs, north end of Fish Spring Mountains, southwest of Granite Mountains, Juab County.	.....	.....	78	.....	.....
Geysar (?) 2½ miles south of Panguitch, Garfield County.	.....	.....	.....	.....	.....
Hot springs:					
In Juab County, 30 miles north of Deseret, Millard County.	20+	.....	178	Saline, chalybeate.	Do.
Three miles west of Salt Marsh, Snake Valley, Millard County.	.....	.....	.....	.....	.....
Two and one-half miles north of Honeyville, Box Elder County.	5	.....	132	Saline.....	Do.
Two and one-half miles north of city limits of Salt Lake City, Salt Lake County.	.....	.....	126	...do .....	Do.
Six or seven miles north of Utah Lake, in Utah County.	.....	.....	128	.....	Probably same as spring near Draper.
Sixteen miles west of Minersville, Beaver County.	.....	.....	185	.....	.....
In Spanish Fork Cañon, Wasatch Co.	.....	.....	145	.....	.....
Hot Sulphur Springs, south end of Great Salt Lake Desert, near Fish Springs, Juab County.	9	.....	139	Saline, chalybeate.	Unimproved.
Iron Springs, 8 or 9 miles northwest of Cedar City, Iron County.	12+	500+	.....	Saline, chalybeate.	Do.
Jones's Warm Spring, ¼ mile northwest of Salt Lake City, Salt Lake County.	1	.....	93	Saline.....	.....

*Mineral springs of Utah—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Knoll Springs, 20 miles north of Lake Creek, Millard County.	.....	.....	69	Sulphureted	.....
Locomotive Springs, near Seco, at north end of Great Salt Lake, Box Elder Co.	.....	.....	.....	.....	.....
<i>Mineral springs:</i>	.....	.....	.....	.....	.....
Fifteen miles southwest of Snowville, Box Elder County.	.....	.....	.....	.....	Unimportant.
In Tooele Valley, Tooele County	.....	.....	.....	.....	.....
Mound Springs, 3 miles above Plymouth, Box Elder County.	4	1, 000	Hot	.....	Local resort.
Salt Lake City Warm Spring, northwest part of Salt Lake City, Salt Lake Co.	1	32, 903	103	Saline, sulphureted.	Used for bathing mainly.
<i>Salt springs:</i>	.....	.....	.....	.....	.....
At Monument Point, near end of Salt Lake, Box Elder County.	.....	.....	.....	.....	.....
In Hansell Spring Valley, Box Elder County.	.....	.....	.....	.....	.....
Eight miles west of Deweyville, Box Elder County.	.....	.....	.....	.....	.....
On Salina Creek, east of Salina, Sevier County.	.....	.....	.....	.....	.....
<i>Sulphur springs:</i>	.....	.....	.....	.....	.....
On Cliff Creek, south of Yampa Plateau, Uintah County.	.....	.....	.....	.....	.....
East side of Cedar Mountains, Tooele County.	.....	.....	.....	.....	.....
South end of Deep Creek Mountains, 28 miles southwest of Fish Spring, Juab County.	.....	.....	.....	.....	.....
In Iron County, thirty-three miles southwest of Minersville.	.....	.....	.....	.....	.....
Thermal spring, near Pah-Van Butte, in Sevier Desert.	.....	.....	.....	.....	.....
Undine Spring, Labyrinth Cañon, Emery County.	.....	.....	.....	.....	.....
Utah or Bear River Hot Springs, 8 or 10 miles north of Ogden City, Weber County.	12	6, 500	132 to 136	Saline, chalybeate.	Bathing resort.
Virgin Hot Springs, near Virgin City, Washington County.	.....	.....	.....	.....	Local resort.
Warm and Hot Springs, near Midway, Wasatch County.	20	500+	116	.....	Used locally by farmers.
<i>Warm springs:</i>	.....	.....	.....	.....	.....
At mouth of Ogden Cañon, Weber County.	2	.....	150	Saline, calcic	.....
On west side of Stansbury Range, Tooele County.	1	.....	74	Saline	.....
At north end of Stansbury Range, near Grantsville, Tooele County.	12	.....	91	do	.....
At west base of Mineral Range, Beaver County.	.....	.....	74	.....	.....
At head of Provo Cañon, Utah Co.	.....	.....	72	.....	.....
Near Cave Spring Settlement	.....	.....	90	.....	.....
Near Cañon of Colorado	.....	.....	91	.....	.....
At north end of Utah Lake, Utah Co.	.....	.....	.....	.....	.....
East side of Promontory Point, Box Elder County.	1	.....	84	.....	.....
Near Granite Mountain, Juab (?) Co.	.....	.....	.....	Saline	.....
Three-fourths of mile south of Fish Springs, Juab County.	3	.....	84½	.....	.....
One and one-half miles south of Fish Springs, Juab County.	2	.....	81	.....	.....
On south edge of salt marsh in Snake Valley, Millard County.	.....	.....	67	.....	.....
On west slope of Mineral Range, Beaver County.	.....	.....	.....	.....	.....
<i>Warm sulphur springs:</i>	.....	.....	.....	.....	.....
On north side of Ogden Cañon, Weber County.	.....	.....	.....	.....	.....

*Analyses of mineral springs in Utah.*

Constituents.	Carbonated Spring, near Draper.	Hot Spring, 2½ miles north of Salt Lake City.	Hot Spring, in region of Great Salt Lake.	Jones's Warm Spring.
	<i>Parts in 1,000.<sup>a</sup></i>	<i>Parts in 1,000.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Parts in 1,000.<sup>d</sup></i>
Calcium carbonate.....	0.35	0.18	10.24	0.36
Magnesium carbonate.....	0.08			0.12
Magnesium sulphate.....	0.02			
Calcium sulphate.....		0.81		1.47
Potassium sulphate.....	0.10			
Sodium chloride.....	1.03	8.05		6.59
Calcium chloride.....		1.09		
Magnesium chloride.....		0.29		0.36
Potassium chloride.....	0.02			0.36
Manganese oxide.....			Trace	
Iron peroxide.....	}	0.01	1.67	Trace
Alumina.....				
Silica.....	0.05	0.18		0.02
Lime.....			23.26	
Chlorine.....			147.37	
Soda.....			122.75	
Magnesia.....			16.58	
Sulphuric acid.....			29.98	
Loss.....			0.15	
Total.....	1.66	10.60	352.00	9.28
<i>Gases.</i>				
Carbonic acid.....	In excess			Present
Sulphureted hydrogen.....				Present

Constituents.	Salt Lake City Warm Spring.			Utah or Bear River Hot Springs.	Warm Spring, near Granite Mountain.
	<i>Grains per gallon.<sup>a</sup></i>	<i>Parts in 1,000.<sup>b</sup></i>	<i>Parts in 1,000.<sup>d</sup></i>	<i>Parts in 1,000.<sup>f</sup></i>	<i>Parts in 1,000.<sup>g</sup></i>
Calcium carbonate.....	} 3.58 {	0.75	0.33		
Magnesium carbonate.....		0.23	0.34	0.2016	
Sodium sulphate.....	5.52	0.65			
Calcium sulphate.....			1.37	0.3094	2.09
Iron chloride.....					0.02
Sodium chloride.....	19.54	8.17	7.72	18.0168	18.14
Calcium chloride.....	4.53	0.06		2.9187	0.58
Magnesium chloride.....	0.54		0.16	0.1398	0.97
Potassium chloride.....			0.34	1.6732	1.07
Iron peroxide.....	} 0.17 {		Trace		Trace
Alumina.....			Trace	0.0040	Trace
Silica.....			0.02	0.0460	
Nitric acid.....					Trace
Sulphureted hydrogen, absorbed.....		0.37			
Total.....	33.88	10.23	10.28	23.3095	22.87
<i>Gases.</i>					
Carbonic acid.....			Present		Trace
Sulphureted hydrogen.....			Present		

<sup>a</sup>I. T. Kingsbury, analyst (1882).

<sup>b</sup>L. D. Gale, analyst (1851).

<sup>c</sup>C. T. Jackson, analyst (1850).

<sup>d</sup>I. T. Kingsbury, analyst (1881).

<sup>e</sup>C. T. Jackson, analyst.

<sup>f</sup>F. W. Clarke, analyst (1884).

<sup>g</sup>I. T. Kingsbury, analyst (1884).

## COLORADO.

Both hot and cold mineral springs abound in Colorado and contribute to the reputation of the State as a health resort. Considering the newness of the State, a fair proportion of its springs have been improved, and several of them have become known all over the country. Among these are Manitou Springs, at the base of Pike's Peak. The authorities for the list given here are the reports and maps of the Hayden Survey and of the Wheeler Survey and Dr. Charles Dennison's Rocky Mountain Health Resorts, supplemented by personal knowledge of a large number of the localities.

*Mineral springs of Colorado.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Alkali Springs, near Monument Park, El Paso County.	.....	.....	°	.....	.....
Alum Spring, in Schell Cañon, Purgatory River, Bent County.	.....	.....	.....	.....	.....
Antelope Springs, Antelope Springs, Hinsdale County.	.....	.....	.....	.....	.....
Agua Caliente, near Capulin, Conejos County.	.....	.....	.....	.....	.....
Artesian Well at Steel Works, Pueblo, Pueblo County.	1	.....	.....	.....	Unimproved.
Artesian Magnetic Mineral Spring, near Union Depot, Pueblo, Pueblo County.	1	5,000	80	Sulpho-saline	Bathing resort.
Burdsall's Soda Lake Springs, Jefferson County.	.....	.....	.....	.....	.....
Cañon City Springs, Cañon City, Frémont County.	3	.....	57	Carbonated	Resort.
Cañon City Hot Spring, 1 mile from Cañon City, Frémont County.	1	.....	104	.....	Do.
Cañon Creek Springs, near Ouray, Ouray County.	} 3	.....	{130 to 158}	Sulphureted, &c.	.....
Carlisle Spring, near Beaver Creek, Pueblo County.	.....	480	65	Saline	.....
Chalk Creek Hot Springs, near Heywood, Chaffee County.	12	.....	150	Chalybeate, &c.	.....
Chalybeate Spring, in Spring Bottom of Arkansas River, Bent County.	.....	.....	.....	.....	.....
Cottonwood Hot Springs, Cottonwood Springs, Chaffee County.	.....	.....	.....	.....	.....
Elbert Iron Spring, near Rockwood, La Plata County.	1	.....	90?	Chalybeate	Unimproved.
Estes Park Springs, Estes Park, Larimer County.	2	.....	58	Saline, chalybeate.	Do.
Hartsel Hot Mineral Springs, Hartsel, Park County.	5	.....	105	Sulphureted	Resort.
Hauman Hot Springs, east side San Luis Valley, Saguache County.	.....	.....	.....	.....	.....
Hot springs: On South Fork of Navajo River, southwest of Banded Peak, Conejos County.	.....	.....	80?	Sulphureted	.....
On Rock Creek, near Sopris Peak, Gunnison County.	} 12+	.....	{30 to 104}	.....	.....
Hot Sulphur Springs, Middle Park, Grand County.	} 22	16,980	{91 to 117}	Sulphureted	Do.
Idaho Hot Soda Springs, Idaho Springs, Clear Creek County.	} ....	2,000	{85 to 120}	Alkaline, saline	Do.

*Mineral springs of Colorado—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Iron Lake Springs, near Silverton Pass, San Juan County.	.....	.....	o	Chalybeate .....	.....
Iron Springs, Bent County, northeast of Thatcher.	.....	.....	.....	do .....	.....
Iron Springs, 12 miles from Telluride, San Miguel County.	.....	.....	.....	.....	.....
Liberty Hot Springs, Wagon Wheel Gap, Rio Grande County.	} 3	.....	{ 140 to 150	Saline .....	Resort.
Manitou Springs, Manitou Springs, El Paso County.	} 9	395	{ 43 to 60	Carbonated, saline, chalybeate.	} Do.
<i>Mineral springs:</i>					
Mouth of cañon, on Purgatory River, Bent County.	.....	.....	.....	.....	Unimproved.
On Caddo Creek, 20 miles above mouth, Bent County.	.....	.....	.....	.....	Do.
Near Conejos, Conejos County.....	.....	.....	.....	Thermal .....	.....
Four or five miles east of Cañon City, Frémont County.	.....	.....	.....	.....	.....
Three miles southeast of Pagosa Springs, Conejos County.	.....	.....	.....	.....	.....
One mile below Pagosa Springs, Conejos County.	.....	.....	6	.....	Do.
On Cement Creek, near East River, Gunnison County.	.....	.....	.....	Calcic .....	Do.
In Bidwell Basin, near Irwin, Gunnison County.	.....	.....	.....	Sulphureted, chalybeate.	Do.
On White Earth River, Gunnison County.	} 5	.....	{ 48 to 84	Carbonated, calcic, and chalybeate.	} Do.
Mineral Park Well (artesian), on Arkansas River, $\frac{1}{2}$ mile above Pueblo, Pueblo County.	1	.....	.....	.....	Used for bathing.
Morrison Spring, Morrison, Jefferson County.	1	.....	.....	Sulphureted .....	Resort.
Mound Soda Springs, Currant Creek, 9 miles from head, Park County.	3	.....	.....	Carbonated, alkaline.	Unimproved.
Ojos de los Caballos, San Luis Valley, Saguache County.	.....	.....	.....	.....	.....
Ouray Mineral Springs, Ouray, Ouray County.	} 9	.....	{ 120 to 140	Alkaline, carbonated, sulphureted.	.....
Pagosa Springs, Pagosa Springs, Conejos County.	4	.....	148	.....	Resort.
Parnassus Springs (or Red Creek Springs), Red Creek, near Beulah, Pueblo County.	} 5	.....	{ 59 to 71	Carbonated, saline, and sulphureted.	} Has a local reputation.
Pinkerton Springs, 5 miles west of Trimble, La Plata County.	.....	.....	95	Alkaline .....	Unimproved.
Poncho Hot Springs, Poncho Springs, Chaffee County.	} 100+	1,000,000	{ 96 to 168	.....	Resort.
Porter's Spring, Denver, Arapahoe County.	.....	.....	60	Sulpho-chalybeate.	Improved.
Salt Creek Spring, Salt Creek, Pueblo County.	1	7,000	.....	Saline .....	Used locally.
<i>Salt springs:</i>					
Between Fort Lyon and Kit Carson, Bent County.	.....	.....	.....	.....	.....
At Buffalo Springs, South Park, Park County.	.....	.....	.....	.....	.....
Seltzer Mineral Springs (formerly Peabody Springs), Springdale, Boulder County. <sup>1</sup>	3	1,000+	.....	.....	Resort and used commercially.
Shaw's Magnetic Springs, 5 miles from Del Norte, Rio Grande County.	.....	.....	.....	.....	Resort.

<sup>1</sup> Walton describes these springs under the name "Rocky Mountain Springs," but the proprietor says he is at a loss to know the derivation of the name.

*Mineral springs of Colorado—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Soda springs:</i>			°		
Six miles south of Cañon City, Frémont County.	.....	.....	.....	.....	.....
East of Dillon, Summit County.	.....	.....	.....	.....	.....
West of Leadville, Lake County.	.....	.....	.....	.....	.....
On Pine Creek, south of Texas Creek, Frémont County.	.....	.....	.....	.....	.....
South Park Springs, south end of South Park, Park County.	.....	.....	.....	.....	.....
Steamboat Springs, Steamboat Springs, Routt County.	30	.....	.....	Saline, sulphureted.	Resort.
Stinking Springs, 2 miles from Salt Creek Springs, Pueblo County.	.....	.....	.....	.....	Unimproved.
<i>Sulphur springs:</i>					
Near head of Cement Creek, Gunnison County.	.....	.....	.....	.....	.....
East of Chicoso, Las Animas Co.	.....	.....	.....	.....	.....
Three miles from Crested Butte, Gunnison County.	.....	.....	.....	.....	.....
On Grand River, near Gypsum, Eagle County.	.....	.....	.....	.....	.....
On Frying-Pan Creek, Pitkin Co.	.....	.....	.....	.....	.....
Nineteen miles east of Huerfano, Huerfano County.	.....	.....	.....	.....	.....
Three miles west of Trinidad, Las Animas County.	.....	.....	.....	.....	.....
Tomichi Hot Springs, near Elgin, Gunnison County.	} 75	.....	{ 140 to 160 }	Saline, sulphureted.	} Local resort.
Trimble Springs, Trimble, La Plata County.	2	.....	130	Alkaline, saline.	Resort.
Tripp Springs, near Trimble, La Plata County.	.....	.....	95	Alkaline.	Unimproved.
Uncompahgre Springs, Uncompahgre Park, Ouray County.	.....	.....	.....	.....	.....
Wellsville Warm Springs, Wellsville, Frémont County.	.....	.....	.....	.....	Do.

*Analyses of mineral springs in Colorado.*

Constituents.	Cañon City Springs.			
	Iron Duke.	Little Duke.	Big Ute.	Aqua Vida.
	<i>Parts in 100.*</i>	<i>Parts in 100.*</i>	<i>Parts in 100.*</i>	<i>Parts in 100.*</i>
Sodium carbonate .....	0. 1267	0. 1266	0. 0594	0. 1258
Calcium carbonate .....	0. 0535	0. 0374	0. 0732	0. 0678
Magnesium carbonate .....	0. 0249	0. 0234	0. 0257	0. 0302
Sodium sulphate .....	0. 0201	0. 0207	0. 0280	0. 0249
Sodium chloride .....	0. 1372	0. 1956	0. 2258	0. 2070
Total .....	0. 3626	0. 4040	0. 4122	0. 4559

\*Oscar Loew, analyst (1875).

*Analyses of mineral springs in Colorado—Continued.*

Constituents.	Cañon City Springs.		Hot Spring, South Fork of Navajo River.	Rocky Mountain Springs. <sup>a</sup>
	Congress Spring.	Hot Spring.		
	<i>Parts in 100.<sup>b</sup></i>	<i>Parts in 100.<sup>b</sup></i>	<i>Parts in 100,000.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Sodium carbonate.....	0.0332	0.0119		3.79
Calcium carbonate.....	0.0482	0.0553	10.20	43.31
Magnesium carbonate.....	0.0300	0.0211	17.10	0.39
Iron carbonate.....				2.89
Sodium sulphate.....	0.0310	0.0134		104.60
Calcium sulphate.....			61.50	
Sodium silicate.....				4.00
Sodium chloride.....	0.0652	0.0301		4.96
Sodium iodide.....				} 1.30
Sodium bromide.....				
Total.....	0.2063	0.1320	88.80	165.24

Constituents.	Hot Sulphur Springs, Middle Park.			
	Spring No. 1.	Spring No. 2.	Spring No. 3.	Spring No. 4.
	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>d</sup></i>
Sodium carbonate.....	58.57	50.45	20.37	29.42
Calcium carbonate.....	10.08			8.46
Magnesium carbonate.....	6.57	4.14		2.66
Sodium sulphate.....	8.48	8.97	17.53	14.25
Potassium sulphate.....	0.50	0.07	1.03	7.03
Magnesium sulphate.....			5.26	
Sodium silicate.....		1.46		
Sodium chloride.....	14.61		13.29	12.18
Silica.....			0.61	0.54
Magnesia.....		Trace		
Lithia.....	Trace	Trace	Trace	
Iron.....	Trace	Trace	Trace	Trace
Ammonia.....			Trace	Trace
Carbonic acid (free).....	2.94		8.42	0.42
Total.....	101.75	65.09	66.51	74.96

Constituents.	Hot Sulphur Springs, Middle Park.		Estes Park Springs.	
	Spring No. 5.	Spring No. 6.	River Spring.	Ranch Spring.
	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Parts in 100,000.<sup>e</sup></i>	<i>Parts in 100,000.<sup>e</sup></i>
Sodium carbonate.....	39.37	22.42		
Calcium carbonate.....	3.68	6.43	2.84	6.89
Magnesium carbonate.....	1.93		2.01	1.83
Iron carbonate.....			6.66	3.12
Sodium sulphate.....	9.85	25.11		
Potassium sulphate.....	0.96	1.69	0.99	1.09
Sodium chloride.....	13.97	13.11	1.31	1.32
Silica.....	1.31	1.36	0.78	0.99
Alumina.....			Trace	Trace
Iron.....	Trace	Trace		
Ammonia.....	Trace	Trace		
Organic matter.....			1.79	2.06
Carbonic acid (free).....	9.49	4.69		
Total.....	80.56	74.81	16.38	17.30

<sup>a</sup> Probably Seltzer Springs.<sup>b</sup> Oscar Loew, analyst (1875).<sup>c</sup> C. T. Jackson, analyst.<sup>d</sup> E. J. Mallet, jr., analyst (1875).<sup>e</sup> C. F. Chandler, analyst.

*Analyses of mineral springs in Colorado—Continued.*

Constituents.	Idaho Hot Soda Springs.	Seltzer Mineral Springs.	Porter's Spring.	Hartsel Hot Mineral Springs.	Carlisle Spring.	Chalk Creek Hot Springs.
	<i>Parts in 100,000.<sup>a</sup></i>	<i>Parts in 100,000.<sup>b</sup></i>	<i>Parts in 100,000.<sup>c</sup></i>	<i>Parts in 100,000.<sup>d</sup></i>	<i>Parts in 100,000.<sup>e</sup></i>	<i>Parts in 100,000.<sup>d</sup></i>
Sodium carbonate.....	52.81	9.37	9.97	130.55	15.42	.....
Potassium carbonate.....	.....	.....	.....	.....	.....	0.23
Calcium carbonate.....	16.32	74.29	17.63	19.89	38.40	3.35
Magnesium carbonate.....	4.94	1.14	1.71	11.09	19.52	1.08
Iron carbonate.....	7.07	6.86	2.57	.....	0.51	.....
Sodium sulphate.....	50.34	184.46	47.23	9.69	34.28	10.58
Potassium sulphate.....	.....	.....	0.52	.....	1.20	.....
Magnesium sulphate.....	32.09	.....	.....	.....	.....	.....
Sodium silicate.....	6.99	6.86	1.54	.....	.....	4.45
Sodium sulphide.....	.....	.....	3.27	.....	.....	.....
Sodium chloride.....	7.13	8.51	9.14	165.03	19.30	.....
Potassium chloride.....	.....	.....	.....	32.58	.....	1.09
Magnesium chloride.....	.....	.....	1.95	.....	.....	.....
Sodium iodide.....	}	2.23	.....	.....	.....	.....
Sodium bromide.....			.....	.....	.....	.....
Silica.....	.....	.....	.....	0.92	Trace	.....
Lithia.....	.....	.....	.....	.....	.....	Trace
Alumina.....	.....	.....	.....	0.65	.....	.....
Ammonia.....	.....	.....	Trace	.....	.....	.....
Organic matter.....	.....	.....	.....	.....	Trace	Trace
Sulphur.....	.....	.....	.....	Present	.....	.....
Total.....	177.69	293.72	95.54	370.40	128.63	24.27

Constituents.	Manitou Springs.					
	Iron Ute Spring.	Little Chief Spring.	Manitou Spring.	Navajo Spring.	Ute Soda Spring.	Shoshone Spring.
	<i>Parts in 100,000.<sup>e</sup></i>	<i>Parts in 100,000.<sup>e</sup></i>	<i>Parts in 100,000.<sup>e</sup></i>	<i>Parts in 100,000.<sup>e</sup></i>	<i>Parts in 100,000.<sup>e</sup></i>	<i>Parts in 100,000.<sup>e</sup></i>
Sodium carbonate.....	59.34	15.16	52.26	124.69	23.82	88.80
Calcium carbonate.....	59.04	75.20	111.00	129.40	40.00	} 108.50
Magnesium carbonate.....	14.56	13.01	20.51	31.66	6.10	
Lithium carbonate.....	Trace	Trace	0.21	0.24	Trace	Trace
Iron carbonate.....	5.78	1.80	Trace	.....	1.40	.....
Sodium sulphate.....	30.86	51.88	19.71	18.42	12.24	37.08
Potassium sulphate.....	7.01	6.24	13.35	16.21	Trace	5.12
Sodium chloride.....	31.59	47.97	40.95	39.78	13.93	42.12
Silica.....	2.69	2.22	2.01	1.47	Trace	Trace
Total.....	210.87	213.48	260.00	361.87	97.49	281.62

<sup>a</sup>I. G. Pohle, analyst.<sup>b</sup>C. T. Jackson, analyst (1877).<sup>c</sup>E. J. Mallet, jr., analyst.<sup>d</sup>George E. Patrick, analyst.<sup>e</sup>Oscar Loew, analyst (1875).

*Analyses of mineral springs in Colorado—Continued.*

Constituents.	Liberty Hot Springs.			Parnassus Springs.		
	Spring No. 1.	Spring No. 2.	Spring No. 3.	Spring No. 1.	Spring No. 2.	Spring No. 5.
	<i>Parts in 100,000.<sup>a</sup></i>	<i>Parts in 100,000.<sup>a</sup></i>	<i>Parts in 100,000.<sup>a</sup></i>	<i>Parts in 100,000.<sup>a</sup></i>	<i>Parts in 100,000.<sup>a</sup></i>	<i>Parts in 100,000.<sup>a</sup></i>
Sodium carbonate .....	69.42	Trace	144.50	126.04	118.45	73.32
Calcium carbonate .....	13.08	31.00	} 22.42	71.00 {	54.54	46.91
Magnesium carbonate .....	10.91	5.10			22.43	17.03
Lithium carbonate .....	Trace	Trace	Trace	Trace	1.78	0.15
Iron carbonate .....				1.54	2.23	2.75
Sodium sulphate .....	23.73	10.50	13.76	8.78	3.98	3.28
Potassium sulphate .....	Trace	Trace	Trace	19.22	18.44	14.54
Sodium chloride .....	29.25	11.72	33.34	102.96	104.13	53.23
Silica .....	5.73	1.07	4.75	4.21	7.94	6.00
Organic matter .....	Trace	Trace	Trace	Trace	Trace	
Sulphureted hydrogen .....	Trace	12.00				Trace
Carbonic acid .....				In excess	In excess	In excess
Total .....	152.12	71.39	218.77	333.75	333.92	217.21

Constituents.	Pagosa Springs.			
	Spring No. 1.	Spring No. 2.	Spring No. 3.	Spring No. 4.
	<i>Parts in 100,000.<sup>a</sup></i>	<i>Parts in 100,000.<sup>a</sup></i>	<i>Parts in 100,000.<sup>a</sup></i>	<i>Parts in 100,000.<sup>a</sup></i>
Sodium carbonate .....	4.70	3.33		58.73
Calcium carbonate .....	59.00	59.50	54.51	3.59
Magnesium carbonate .....	4.85	3.92	3.68	224.59
Lithium carbonate .....	0.71	Trace	Trace	Trace
Sodium sulphate .....	221.66	220.20	223.92	7.10
Potassium sulphate .....	7.13	6.98	6.63	29.81
Sodium chloride .....	29.25	29.36	31.21	3.82
Silica .....	5.70	5.21	5.53	Trace
Organic matter .....	Trace	Trace	Trace	
Total .....	333.00	328.50	325.48	327.64

<sup>a</sup> Oscar Loew, analyst (1875).

## NEW MEXICO.

In many portions of New Mexico, alkaline and saline waters (many of them warm or hot) are doubtless more prevalent than are pure waters. The mineral springs that are utilized for medicinal purposes are numerous, and some of them were used years ago by the Franciscan and Dominican friars, and by the Indians prior to the advent of Europeans. Many of the hot springs have widespread reputations throughout the Southwest. Among those most used at the present time are Las Vegas, Jemes, Joseph's Ojo Caliente, and Hudson's Hot Springs. The present list for the Territory is compiled mainly from information furnished by members of the United States Geological Survey whose field of work has been in New Mexico. Various Government exploration and geological reports and hand-books have also been drawn upon. The analyses, with one exception, have been taken from the Report of the United States Geographical Survey West of the 100th Meridian (Vol. III, Geology).

*Mineral springs of New Mexico.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Apache Tejo Warm Springs, south of Fort Bayard, Grant County.	.....	.....	89	.....	.....
Aqua Caliente, near Mesilla (?), Dona Ana County.	.....	.....	.....	.....	.....
Aztec Spring (Ojo Xigante), 4 miles east of Santa Fé, Santa Fé County.	.....	.....	.....	.....	Water is on sale in Santa Fé.
Cabello Springs (?), 5 miles from Fort McRae, Socorro County.	.....	.....	136	.....	.....
Geyser in Bernalillo County, 12 miles northeast of Fort Wingate.	.....	.....	Warm	.....	.....
Hudson's Hot Springs, near Hudson, 4 miles northwest of Mimbres, Grant County.	.....	.....	.....	.....	Resort.
Hot springs:					
In San Diego Cañon, on San Antonio Creek, north of Jemes, Bernalillo County.	.....	.....	.....	.....	.....
Near the Rio Grande, north of Palomas, Socorro County.	.....	.....	.....	.....	.....
On Diamond Creek, near mouth, Socorro County.	.....	.....	151	.....	.....
Gila River, near Diamond Creek, Socorro County.	.....	.....	100	.....	.....
Jemes Hot Springs (lower group), twelve miles above Jemes, Bernalillo County.	} 10+	.....	{ 94 to 168 }	Saline.....	Do.
Jemes Hot Springs (upper group), San Diego Cañon, 14 miles above Jemes, Bernalillo County.			{ 70 to 105 }	do.....	Do.
Las Vegas Mineral and Hot Springs, near Las Vegas, San Miguel County.	} 40	.....	{ 75 to 140 }	Alkaline, saline.	Do.
Mineral springs:					
Three miles east of Gallup, Bernalillo County.	.....	.....	.....	.....	.....
Eighteen miles west of Abiquiu, Rio Arriba County.	.....	.....	.....	.....	.....
Five miles east of Ojo Azufre, Bernalillo County.	.....	.....	.....	Alkaline.....	.....
East of Great Ranch and 3 miles northeast of Las Vegas, San Miguel County.	.....	.....	.....	Alkaline, sulphureted.	.....
Ojo Azufre, Bernalillo County, 20 miles west of Fort Wingate.	.....	.....	.....	Sulphureted, &c.	.....
Ojo Caliente (Joseph's), Taos County, 12 miles from Barranca, north of Abiquiu.	} 4+	6,000	{ 108 to 122 }	Alkaline and saline, thermal.	Used commercially and as a resort.
Ojo Caliente, Mimbres River, 15 miles north of Mimbres, Grant County.			.....	.....	
Ojo Caliente, 12 miles southwest of Zuñi, Valencia County.	.....	.....	85	.....	.....
Ojo Caliente, near Cherryville and Canada Alamosa, Socorro Co.	.....	.....	.....	.....	.....
Ojo Sarco, on Rio Grande north of Santa Barbara, Taos County.	.....	.....	.....	.....	.....
San Ysidro Spring, near Jemes, Bernalillo County.	.....	.....	.....	Carbonated.....	.....
Soda springs:					
Three miles north of Ojo Caliente, Taos County.	.....	.....	.....	.....	.....
On Salado Creek, 4 or 5 miles south of San Ysidro, Bernalillo County.	.....	.....	.....	.....	.....
Four or 5 miles south of Carrigo Valley, Socorro County.	.....	.....	.....	.....	.....
Thirteen miles northeast of Isleta, Bernalillo County.	.....	.....	.....	.....	.....
Stinking Spring, 10 miles northeast of Coolidge, Valencia Co.	.....	.....	.....	Sulphureted.....	.....

Mineral springs of New Mexico—Continued.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Sulphur springs:</i> In Chusca Valley, Rio Arriba County.	.....	.....	o	.....	.....
West of Mesa Lucera, Valencia County.	.....	.....	.....	.....	.....
Five miles south of Taos, Taos County.	.....	.....	.....	.....	.....
<i>Warm springs:</i> Near Hudson, 6 miles northwest of Mimbres, Grant Co.	.....	.....	150	.....	.....
At head of San Diego Cañon, Rio Arriba County.	.....	.....	.....	.....	.....
At copper mines of Rio San Francisco, Socorro Co.	.....	.....	130	.....	.....
Warm Sulphur Spring, Rio Pajarito, Taos County.	.....	.....	68	.....	.....

Analyses of mineral springs in New Mexico.

Constituents.	Ojo Caliente (Joseph's).		Jemes Hot Springs.			Las Vegas Mineral and Hot Spring.
	Spring No. 1.	Spring No. 2.	Geyser.	Spring No. 3.	Spring in upper group.	
	<i>Parts in 100,000. <sup>a</sup></i>	<i>Parts in 100,000. <sup>a</sup></i>	<i>Parts in 100. <sup>a</sup></i>	<i>Parts in 100. <sup>a</sup></i>	<i>Parts in 100. <sup>a</sup></i>	<i>Parts in 100,000. <sup>a</sup></i>
Sodium carbonate.....	196.95	184.29	.....	.....	0.0219	120.00
Calcium carbonate.....	6.25	5.40	0.0641	0.0300	0.0548	} 13.75
Magnesium carbonate.....	.....	.....	0.0103	0.0240	0.0057	
Lithium carbonate.....	0.21	0.16	.....	.....	.....	.....
Iron carbonate.....	Trace	Trace	.....	0.0002	.....	.....
Sodium sulphate.....	13.60	19.33	0.0035	.....	0.0059	5.26
Potassium sulphate.....	5.17	5.34	.....	.....	.....	.....
Calcium sulphate.....	.....	.....	Trace	0.0262	.....	.....
Sodium chloride.....	38.03	39.78	0.1622	0.1508	0.2642	6.41
Silica.....	Trace	Trace	Trace	0.0010	0.0201	Trace
Potassa.....	.....	.....	Trace	Trace	Trace	.....
Lithia.....	.....	.....	Trace	Trace	Trace	.....
Phosphoric acid.....	.....	.....	.....	Trace	Trace	.....
Total.....	260.21	254.30	0.2401	0.2322	0.3726	<sup>b</sup> 145.42

Constituents.	San Ysidro Spring.	Warm Sulphur Spring, Rio Pajarito.	Las Vegas Mineral and Hot Springs.			Aztec Spring.
			Spring No. 1.	Spring No. 2.	Spring No. 3.	
	<i>Parts in 100. <sup>a</sup></i>	<i>Parts in 100,000. <sup>a</sup></i>	<i>Parts in 100,000. <sup>a</sup></i>	<i>Parts in 100,000. <sup>a</sup></i>	<i>Parts in 100,000. <sup>a</sup></i>	<i>Parts in 100,000. <sup>b</sup></i>
Sodium carbonate.....	.....	17.01	1.72	1.17	5.00	.....
Calcium carbonate.....	0.0670	} 7.19	9.08	10.63	11.41	} 0.1538
Magnesium carbonate.....	0.0243					
Iron carbonate.....	0.0008	.....	.....	.....	.....	.....
Sodium sulphate.....	0.1639	14.66	14.12	15.93	16.27	0.0225
Calcium sulphate.....	.....	.....	.....	.....	.....	0.0050
Sodium chloride.....	0.3072	9.11	27.26	24.37	27.34	0.0193
Silica.....	Trace	Trace	1.04	Trace	2.51	0.0220
Potassa.....	Trace	Trace	Trace	Trace	Trace	.....
Lithia.....	Trace	Trace	Strong trace	Strong trace	Strong trace	.....
Total.....	0.5632	47.91 <sup>c</sup>	53.22	52.10	62.53	0.2831

<sup>a</sup> Oscar Loew, analyst (1875).

<sup>b</sup> F. W. Clarke, analyst (1885).

<sup>c</sup> Contains carbonic acid and hydrogen sulphide also.

## ARIZONA.

Definite information relating to the mineral springs of Arizona is difficult to obtain, and the list given here is not offered as complete. In some portions of the Territory alkaline, saline, and sulphureted waters are so numerous that they attract but little attention. So far as can be ascertained, none of the springs included in the table has been improved, although the Monroe Springs are said to have been used to some extent for bathing. Saline springs appear to be most abundant and a large number of them are thermal. Many of them will probably be utilized for medicinal purposes as the country becomes more thickly populated. The few analyses given have been derived from Vol. III (geology) of Wheeler's survey reports.

*Mineral springs of Arizona.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.
Alkali springs, in Boo-koo-der-klish Cañon, Apache County .....			o	Saline, alkaline.
Agua Caliente, opposite Burke's Station, on Gila River, Maricopa County .....				Saline.
Agua Sal Creek, southwest of Carriso Mountain, Apache County .....				
Bitter Spring, south of Lee's Ferry, on Colorado River, Yavapai County .....				
Croton Springs, in Sulphur Springs Valley, Cochise County .....	2			Do.
Gypsum Spring, in Detrital Valley, Mohave County .....				Do.
Hos-hi-ti-to Spring, southwest of Carriso Mountain, Apache County .....				Do.
<i>Hot springs:</i>				
Opposite mouth of Cabicu Creek, Gila County .....				
East of Black Cañon of Colorado River, Mohave County .....				
On Rio San Francisco, 7 miles above the mouth, Graham County .....	4		127-130	Do.
Lava springs, in Grand Cañon of Colorado River, Mohave County .....			89	
Mineral springs, 13 miles northwest of Green's Peak, Apache County .....				
Mineral Park Bitter Spring, in Cerbat Range, Mohave County .....				
Monroe Hot Spring, Castle Creek, 60 miles south of Prescott, Maricopa County. (Bathing resort.) .....	1	4,200	150-160	
Not-tahn-de-let Spring, 20 miles north of Keam's Cañon, Apache County .....				Alkaline, saline.
Pahgun Spring, in Grand Wash of Colorado, Mohave County .....			100	
<i>Salt springs:</i>				
Along cañon of Salt River, Gila County .....				
South of Stone's Ferry, on Colorado River, Mohave County .....				
Fifty or 60 miles northeast of Williams's Trading Post, Apache Co. ....				
On the Colorado Chiquito, near Hardy, Apache County .....				
Sand Cave Spring, Apache County, 50 miles northwest of Fort Defiance .....				Sulphureted.
Shanto Spring, 40 miles northwest of Fort Defiance .....			Tepid.	
Shanto Spring, 50 miles northwest of Williams's Trading Post, Apache County .....			do	Alkaline.
Sulphur Spring, southwest of Camp Bowie, Cochise County .....				
<i>Thermal springs:</i>				
Near Tubac, Pima County .....				
On Prieto River, Graham County .....				

*Analyses of mineral springs in Arizona.*

Constituents.	Mineral Park, Bitter Spring.	Gypsum Spring, Detrital Valley.	Hot Springs, Rio San Francisco.
	<i>Parts in 100,000.*</i>	<i>Parts in 100,000.*</i>	<i>Parts in 100.*</i>
Magnesium carbonate.....		Trace	
Calcium carbonate.....		12.0	
Sodium sulphate.....	Trace	51.6	
Magnesium sulphate.....	65.3	172.8	
Calcium sulphate.....	118.5	130.1	0.0410
Iron sulphate.....	Trace		
Manganese sulphate.....	Trace		
Sodium chloride.....		397.8	0.3252
Potassium chloride.....		Trace	
Magnesium chloride.....	5.4		0.1025
Calcium chloride.....			0.1981
Total.....	189.2	764.3	0.6668

\* Oscar Loew, analyst (1875).

## NEVADA.

The State of Nevada is better off in respect to springs than in regard to streams of running water. She occupies a prominent place as a mineral-spring State. Both hot and cold springs (the former predominating) are found in every county. Walton's work credits the State with two localities, and yet there are at least ten localities that are utilized for medicinal purposes, and many of them were so used by the Indians long before settlements were made by the whites. Our table includes more than one hundred localities, and yet only a part of the actual number of springs are given, for some of the groups contain as many as forty or fifty or even more individual springs. It is impossible at present to give the total number of springs. Steamboat Springs is probably the best known resort, as it has long been readily accessible. The warm and hot springs are found mainly in connection with geological fault-lines or fractures of the strata. Salt springs and borax springs are numerous. Sulphureted springs are frequently found also. So few of the springs have been analyzed that the greater part of them must be considered as unknown, so far as their chemical character is concerned. The list of springs has been compiled from various maps and such Government reports as were accessible, supplemented by information furnished by members of the United States Geological Survey who have worked in Nevada.

Mr. I. C. Russell and Dr. W. J. Hoffman have added largely to the list from their personal knowledge of the State, and thanks are also due to Mr. L. A. Buckner, of Winnemucca, Nev.

*Mineral springs of Nevada*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Alkali springs:</i>			°		
Seven miles north of Montezuma, Esmeralda County.	.....	.....	.....	.....	.....
Ten miles northwest of Lone Mountain, Esmeralda County.	.....	.....	.....	.....	.....
Allen's Spring, south of Carson's Lake, Churchill County.	.....	.....	.....	.....	.....
Alum Spring, 5 miles northeast of Steamboat Springs, Washoe County.	.....	.....	.....	.....	.....
Bitter Springs, 15 miles southwest of Saint Thomas, Lincoln County.	.....	.....	.....	.....	.....
Butte Spring, north end of Hot Springs, Butte, Humboldt County.	.....	.....	182	.....	.....
Double Spring, north of Walker Lake, Esmeralda County.	.....	.....	Warm.	.....	.....
Double Hot Springs, southwest flank of Black Rock Range, Humboldt County.	.....	.....	191-165	.....	.....
Elko Hot Springs, Elko, Elko County.	.....	.....	.....	.....	Resort.
Franktown Hot Springs, Franktown, Washoe County.	.....	.....	.....	.....	.....
Golconda Hot Springs, Golconda, Humboldt County.	6	.....	150	Chalybeate and sulphur.	Do.
Goodrich Spring, 12 miles from Schellbourne, White Pine County.	28,000	.....	160-185	.....	Unimproved.
Granite Creek Hot Spring, near Alkali Lake, north of Granite Creek Desert, Humboldt County.	.....	.....	.....	.....	.....
Gypsum Spring, 20 miles northeast of Las Vegas, Lincoln County.	.....	.....	.....	.....	.....
<i>Hot springs:</i>					
On north side of Thousand Creek Valley, southwest of Stein Mountains, Humboldt County.	.....	.....	130	.....	Do.
In Soldier Meadows, 15 miles south of Camp McGarry, Humboldt County.	.....	.....	.....	.....	.....
At south end of Stein Mountains, Humboldt County.	.....	.....	178	.....	.....
Ten or 12 miles north of Mason's Crossing of Quinn River, Humboldt County.	2	.....	118-134	Calcif.	.....
On east side of Independence Valley, Elko County.	.....	.....	.....	.....	.....
At northeast end of Ruby Lake, Elko County.	.....	.....	.....	.....	.....
East of Division Peak and south of Pah Ute, Humboldt County.	.....	.....	.....	.....	.....
On northeast side of Pine Valley, north of Mineral Hill, Eureka County.	.....	.....	.....	.....	.....
South of Alkali Lake, east side of Crescent Valley, Eureka County.	.....	.....	.....	.....	.....
On northeast side of Pah Ute Mountains, Churchill County.	.....	.....	.....	.....	.....
In Antelope Valley, near Eagle Lake, Elko County.	.....	.....	.....	.....	.....
Northwest of Sink of Quinn River, Humboldt County.	2	.....	.....	.....	.....
Near Egan Cañon, 15 miles northwest of Schellbourne, White Pine County.	.....	.....	.....	.....	Used for quartz mill and for bathing.
At northwest end of Pyramid Lake, Washoe County.	.....	.....	.....	.....	.....
At north end of Pyramid Lake, Washoe County.	.....	.....	.....	.....	.....
On Carson River, 6 miles northeast of Genoa, Douglas County.	.....	.....	.....	.....	.....
At south end of Smoke Creek Desert, Washoe County.	.....	.....	.....	.....	.....
At north end of Toiyama Range, 18 miles southeast of Austin, Lander County.	.....	.....	.....	.....	.....

*Mineral springs of Nevada—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Hot springs—Continued.</i>			°		
Near junction of Beef and Virgin Creeks, Humboldt County.	.....	.....	108	.....	
On Little Humboldt, north of Hot Spring Creek, Humboldt County.	.....	.....	130	.....	
In Kober Valley, near Grubb's Mill, Eureka County.	.....	.....	.....	.....	
On west side of Smith Creek Valley, Churchill County.	.....	.....	.....	.....	
On west side of Gabb's Valley, Esmeralda County.	.....	.....	.....	.....	
One mile east of Carson City, Ormsby County.	.....	.....	111	.....	Improved.
Ten miles north of Wellington, Lyon County.	.....	91,000	40-140	.....	Resort.
East of Hot Springs Station, Churchill County.	6	.....	158-187	.....	
East of Winnemucca, Humboldt County.	.....	.....	189	.....	
At head of north branch of Little Humboldt, Humboldt County.	.....	.....	.....	.....	
At head of south branch of Little Humboldt, Humboldt County.	.....	.....	.....	.....	
On southwest side of Black Rock Range, Humboldt County.	3	.....	.....	.....	
At south end of Black Rock Range, Humboldt County.	.....	.....	.....	.....	
Near south end of Pine Forest Range, 7 miles from Mason's Crossing of Quinn River, Humboldt County.	.....	.....	155	.....	
In Emigrant Cañon, northeast of Tulasco, Elko County.	.....	.....	.....	.....	
At south end of Thousand Springs Valley, Elko County.	.....	.....	.....	.....	
At Cephas Kyles, 7 miles south of Sue Springs, Churchill County.	.....	.....	125	.....	
At base of Shoshone Range, Reese River Valley, Lander County.	.....	.....	85-117	.....	
In Steptoe Valley, southwest of Ruby Valley, White Pine County.	.....	.....	.....	.....	
Near Silver Peak, Esmeralda County.	11	.....	69-117.8	Saline, &c	
Fourteen miles south of Toyabe City, Nye County.	1	35,000	Boiling	.....	
In Diamond Valley, 30 miles north of Eureka, Eureka County.	.....	.....	.....	.....	
In Hot Spring Range, Nye County.	2	.....	Boiling	.....	
In Salt Valley, east side of Carson Sink Mountains, Churchill Co.	.....	.....	.....	.....	
Hot Sulphur Springs, Carlin, Elko Co.	.....	.....	.....	.....	
Kyle's Hot Springs, 12 or 15 miles east of Star Peak, Humboldt County.	.....	.....	.....	.....	Do.
Las Vegas Springs, Las Vegas, Lincoln County.	.....	.....	73	Calcif	
Leach's Hot Springs, Pleasant Valley, 25 miles south of Winnemucca, Humboldt County.	.....	.....	118	.....	
Mesquit Springs, 10 miles east of Las Vegas, Lincoln County.	.....	.....	.....	.....	
Miller's Hot Springs, 16 miles north of Franklin, Ruby Valley, Elko County.	.....	.....	170	.....	
Mineral Hill Hot White Sulphur Springs (Bruffy's Hot Springs), 4 miles north of Mineral Hill, Eureka County.	5	150+	Boiling	Sulphureted	Do.
<i>Mineral springs:</i>					
Opposite Stonehouse Station, Humboldt County.	.....	.....	.....	.....	
West side of Smoke Creek Desert, Washoe County.	.....	.....	.....	.....	

*Mineral springs of Nevada — Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Muddy Springs, northwest of West Point, Lincoln County.	20+	.....	Hot.....	.....	.....
Mud Springs, Desert Wells, Nye Co.	.....	.....	Hot.....	.....	.....
Nelson Springs, 20 miles south of Golconda, Humboldt County.	.....	.....	.....	Alkaline; saline.	.....
Red Bluff Springs, 10 miles east of Saint Thomas, Lincoln County.	.....	.....	.....	.....	.....
Rotten Egg Springs, west side of Mud Lake, Washoe County.	.....	.....	.....	.....	.....
Salt Well, 1 mile north of Stone's Ferry, Lincoln County.	.....	.....	89.5	Saline	.....
Schellbourne Hot Springs, Schellbourne, White Pine County.	2	.....	.....	.....	Used for irrigation.
Shaw's Hot Springs (formerly Swift's), two miles northeast of Carson City, Ormsby County.	1	4,000	120	Saline	Resort.
Hot water of Ophir Mine, Comstock Lode, Virginia City, Storey County.	.....	.....	.....	.....	.....
Smoky Valley Geysers, Nye County.	.....	4,200+	Boiling	.....	.....
Soda Lakes, 3 or 4 miles east of Ragtown, Churchill County.	.....	.....	.....	Alkaline; saline.	.....
<i>Soda springs:</i>	.....	.....	.....	.....	.....
East of South Carson Lake, Churchill County.	.....	.....	178	.....	.....
South of Silver Peak, Esmeralda County.	.....	.....	.....	.....	.....
Near Butlerfield's, Warm Springs, west of Railroad Valley, Nye Co.	.....	.....	.....	Saline, &c	.....
Steamboat Springs, Steamboat, Washoe County.	.....	.....	204	.....	Do.
Sue (or Gilbert's) Hot Springs, north end of Osobb or Salt Valley, Humboldt County.	.....	.....	160-185	.....	.....
<i>Sulphur springs:</i>	.....	.....	.....	.....	.....
In Esmeralda County, 12 miles southeast of Wellington.	.....	.....	.....	.....	Improved and used as a resort.
In Sodaville, Soda Springs Valley, north of Columbus, Esmeralda County.	.....	.....	.....	.....	.....
At south end of Diamond Valley, Eureka County.	.....	.....	.....	.....	.....
Seven miles east of Montezuma, Esmeralda County.	.....	.....	.....	.....	.....
Eight or 9 miles northeast of Toiyabe City, Nye County.	.....	.....	.....	.....	.....
Twenty miles south of Freyberg, Lincoln County.	.....	.....	.....	.....	.....
In Pahrump Valley, Lincoln Co.	.....	.....	Hot.....	.....	.....
At Sand Spring Flat, 15 miles south of Stillwater, Churchill County.	.....	.....	.....	.....	.....
<i>Thermal springs:</i>	.....	.....	.....	.....	.....
On east side of Little Cedar Mountains, Elko County.	.....	.....	.....	Alkaline	.....
At east base of Keene Mountains, San Antonio, Nye County.	3	.....	.....	.....	.....
Five miles east of Patterson, Lincoln County.	.....	.....	.....	Strongly saline.	.....
Virgin River, Lincoln County.	.....	.....	.....	.....	.....
Volcanic Springs, Whirlwind Valley, Lander County, 10 miles south of Beowawe.	.....	.....	.....	.....	.....
Wabuska Springs, Wabuska, Lyon County.	.....	.....	133-162	.....	.....
Walley's or Genoa Hot Springs, Genoa, Douglas County.	6	600	Hot.....	.....	Resort.
Ward's Hot Springs, foot of Granite Mountains, Humboldt County.	.....	.....	Boiling	.....	.....
<i>Warm springs:</i>	.....	.....	.....	.....	.....
Northwest of Shoshone Mesa, west of Rock Creek, Lander County.	.....	.....	.....	.....	.....

*Mineral springs of Nevada—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Warm springs—Continued.</i>			°		
On White River, in Sierra Valley, 20 miles northeast of Butterfield, Nye County.					
South of Sonoma Range, Humboldt County.					
On west side of King River Valley, Humboldt County.	2		76-80		
Eight miles southwest of Camp Halleck, Elko County.					
At Hiko, Lincoln County			90		
In Pahrimp Valley, Lincoln County					
West of Roberts Mountains, Eureka County.					
Northwest of Tecoma, Elko Co.					
South of Alkali Lake, Reese River Valley, Lander County.					
On west side of Warm Spring Valley, Nye County.					
At north end of Grass Valley, Lander County.					
In Storey County, 10 or 12 miles south of Wadsworth,			73		
At north end of Carico Valley, Lander County.					
At east side of Sonoma Mountains, Humboldt County.					
In Fish Spring Valley, southeast of Danville, Nye County.					
Six miles north of Hot Springs, Smith's Creek Valley, Churchill County.					
In Ash Meadows, Nye County			81.6		
At north end of White Pine Valley, White Pine County.					
West of Fish Creek Range, Lander County.			140		
Warm Sulphur Springs, south end of Spring Valley, White Pine County.					
Whelan's White Sulphur and Mineral Springs, Pine Valley, 12 miles north of Mineral Hill, Eureka County.	3	5,000	108-112		Local resort.

*Analyses of mineral springs in Nevada.*

Constituents.	Larger Soda Lake, near Ragtown.			Ward's Hot Springs, Granite Mountain.	Hot Springs at Hot Spring Station.	Hot water from Ophir Mine.
	Surface water.	30½ inches below surface.	Unspec- ified.			
	<i>Grams per liter.<sup>a</sup></i>	<i>Grams per liter.<sup>a</sup></i>	<i>Parts in 1,000.<sup>b</sup></i>	<i>Grams per liter.<sup>a</sup></i>	<i>Grams per liter.<sup>a</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Sodium carbonate .....	26.410	24.840	29.25	.....	.....	2.82
Magnesium carbonate .....	0.940	0.940	0.06	.....	.....	4.10
Calcium carbonate .....	.....	.....	.....	.....	.....	2.67
Sodium sulphate .....	19.170	19.450	13.76	0.4267	0.4039	2.93
Magnesium sulphate .....	.....	.....	.....	0.0179	0.0050	10.01
Calcium sulphate .....	.....	.....	.....	0.1247	0.1037	.....
Aluminium sulphate .....	.....	.....	.....	.....	0.0063	.....
Potassium sulphate .....	.....	.....	3.65	.....	.....	0.65
Sodium chloride .....	71.470	68.930	64.94	0.3665	1.4946	0.60
Potassium chloride .....	4.820	5.110	.....	0.0363	0.1278	.....
Sodium bichloride .....	0.404	0.417	.....	.....	.....	.....
Sodium sulphide .....	.....	.....	0.24	.....	.....	.....
Sodium silicate .....	.....	.....	.....	0.1942	0.1480	.....
Silica .....	0.304	0.310	0.21	0.0180	0.2060	2.21
Silica free .....	.....	.....	.....	.....	.....	.....
Carbonic acid in ex- cess .....	.....	.....	0.47	.....	.....	.....
Loss .....	1.612	5.153	2.12	0.0059	.....	0.27
Alumina .....	.....	.....	.....	.....	.....	Trace
Total .....	125.130	125.150	114.70	1.1902	2.4953	26.25

\* T. M. Chatard, analyst (1884).

b O. D. Allen, analyst (1877).

c George Atwood, analyst.

## CALIFORNIA.

The States of the Pacific coast are remarkable for the number of their mineral springs, especially of hot and warm springs, and California stands at the head of the list, having probably more localities than any other State, east or west. Our table does not give the total number of individual springs, since complete reports have been received from comparatively few of the localities included. The springs are classified as sulphureted, carbonated, alkaline, saline, chalybeate, and acid. Naturally many of the springs are thermal, for the volcanic rocks with which such springs are usually associated are found in many portions of the State. A large number of the California springs are improved and utilized as places of resort, being visited by thousands of people annually. Many, however, are comparatively inaccessible, and are therefore little known. The best known springs are probably the Geyser Springs of Sonoma County, which are really a collection of fumaroles, solfataras, and boiling springs. There are nearly a dozen localities at which the waters are put up for sale and shipment.

The list of springs given here has been compiled from various sources. The report of Dr. F. W. Hatch, in the Sixth Report of the State Board of Health, for 1880, and various hand-books (among them Truman's Illustrated Guide and U. H. Chittenden's Health and Pleasure Resorts of the Pacific Coast) have been drawn upon in its preparation. Besides these, the reports of the State mineralogist, Henry G. Hanks,

Whitney's geological reports, and the various Government geological publications have been consulted, and all this has been supplemented by reference to the various maps of the State. For the northern portion of the State many additional data, that have never been published, have been obtained from Mr. Gilbert Thompson, Mr. Mark B. Kerr, and Mr. Eugene Ricksecker, of the United States Geological Survey, who have worked in that section of the State recently. Dr. W. J. Hoffman and Mr. I. C. Russell have kindly given information as to other parts of the State.

*Mineral springs of California.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Adams Spring, 2 miles from Cobb's Valley, 8 miles south of Clear Lake, Lake County.	1	.....	.....	Alkaline, carbonated.	Resort.
Ætna Springs, 16 miles northeast from Saint Helena, Napa County.	2+	98-106	.....	.....do.....	Do.
<i>Alkali springs:</i>					
In north end of Mono County.	.....	.....	.....	.....	.....
Eight miles northwest of Quincy, Plumas County.	.....	.....	.....	Alkaline, carbonated.	.....
One mile above mouth of Spanish Creek, Plumas County.	.....	.....	.....	.....do.....	.....
<i>Alkaline lakes:</i>					
Fifteen miles southwest of Alturas, Modoc County.	.....	.....	.....	.....	.....
Near Clear Lake, Lake County.	.....	.....	.....	.....	.....
Alabaster Cave Spring, El Dorado Co.	.....	.....	.....	.....	.....
Alameda Warm Springs, Alameda Co., near San José.	.....	.....	.....	.....	.....
Allen Springs, near head of Cache Creek, Allen Springs, Lake Co.	5	.....	50?	Alkaline, saline, and chalybeate.	Do.
Alum Rock Springs, 7 miles northeast of San José, Santa Clara County.	4+	.....	85	Saline, sulphureted.	.....
Anderson's Springs, Lake County, 19 miles north of Calistoga.	9	.....	.....	.....	Resort to limited extent.
Agua Caliente, in Coahuila or Cabezon Valley, 10 miles south of White River, San Diego County.	.....	.....	100.4	.....	.....
Agua Caliente, 30 miles from Caliente Station, Kern County.	.....	.....	80	Thermal	.....
Arrowhead Hot Springs,? near San Bernardino, San Bernardino County.	.....	140-210	.....	.....	Probably same as San Bernardino.
Azule Mineral Springs, 12 miles west of San José, Santa Clara County.	3	250	.....	.....	Used commercially.
Bartlett Springs, near head of Cache Creek, Bartlett Springs, Lake County.	2+	.....	Cold	Alkaline, saline	Used commercially and as a resort.
Bear Valley Hot Springs, near Bear Lake, north of San Bernardino Peak, San Bernardino County.	.....	.....	.....	.....	.....
Berkeley or Summit Soda Springs, 10 miles south of Summit Station, on Central Pacific Railroad, Placer Co.?	.....	.....	.....	Alkaline	Possibly same as Summit Soda Springs.
Bitter Spring, 18 miles north of Camp Cody, San Bernardino County.	.....	.....	.....	.....	.....
Black Lake, 1 mile west of Benton, Mono County.	.....	.....	.....	Alkaline	.....
Blanck's (Mrs. Lottie) Hot Sulphur Spring, Colusa County.	.....	.....	.....	.....	.....
Boiling Lake, 7 miles south of Lassen's Peak, Plumas County.	.....	.....	.....	.....	.....
Boiling Springs, east side of Dry Salt Lake, west side of Resting Mountains, Inyo County.	.....	.....	.....	.....	.....

*Mineral springs of California—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Boiling Sulphur Springs, northwest of Long Valley, South Branch of Owen's River, Mono County.			o		
Bonanza Springs, 1½ miles from Howard Springs, Lake County.	3			Sulphureted, chalybeate.	Resort.
Borax Flat Springs, near intersection of 117° 15' and 35° 45', San Bernardino Co.					
Borax Marsh Springs, 8 miles southeast of Hawley's Station, San Bernardino County.					
Borax Patch Springs, near Black Ranch, near Central Pacific Railroad, San Bernardino County.					
Boyd's Hot Springs, Surprise Valley, on east side of Upper Alkali Lake, Modoc County.					
Branbeck's Springs, east side of Honey Lake, Lassen County.			Boiling		
Byron Spring, 1 mile from Byron Station, Contra Costa County.	} 1		{ Cold to 135	{ Saline, sulphureted, and carbonated. Alkaline, carbonated.	} Do.
California Seltzer Spring, Mendocino County.					Do.
Calistoga Hot Springs, Calistoga, 9 miles south of Saint Helena, Napa County.	20		97	Saline	Once a resort.
Campbell's Springs (?), Sierra County					
Campo Chalybeate Spring					
Carbonated Spring, north part of Siskiyou County, on Shovel Creek Road.					
Castalian Mineral Water (Owen's Lake?) Inyo County.	13		Cold	Alkaline, sulphureted.	Used commercially and as a resort.
Castle Rock Springs, near Mount Shasta, Shasta County.				Sulphureted	
<i>Chalybeate springs:</i>					
Two miles from Tom's Head Mountain, Tehama County.					
Northwest of Fort Crook, on branch of Bear Creek, near head of Falls River, Shasta County.					
Coal Valley Boiling Springs, 8 miles west of Canby, Modoc County.					
Cold Soda Lake and Hot Springs, head of Mill and Battle Creeks, south of Lassen's Peak, Plumas County.					
Cook's Springs, Indian Valley, Colusa Co.				Sulphureted, &c.	
Crystal Springs (?), Napa County					
Crystal Springs, San Mateo County				Alkaline	
De Luz Hot Springs, near Oceanside, San Diego County.					Unimproved.
Desert or Cave Spring, Kern County				Borax spring, alkaline, Sulphureted	
Dr. Soupan's Hot Sulphur Spring, branch of Battle Creek, at head of road, Plumas County.					
El Paso de Robles Hot and Cold Sulphur Springs, San Luis Obispo Co.	} 5		{ 110 to 140	{ Sulphureted, saline, and chalybeate.	} Resort.
Fresno Hot Springs, near Warthan, Fresno County.					
Fry's Soda Spring, near line of Shasta County, Siskiyou County.			52	Alkaline, carbonated.	
Fulton Wells, 3 miles north of Norwalk Station, Los Angeles County.	2			Sulphureted	Do.
<i>Geysers:</i>					
Near mouth of Willow and Warner Creeks, Plumas County.					
In extreme western end of Long Valley, on South Branch of Owen's River, Mono County.					
On Pluton Creek, northeast part of Sonoma County.	} .....		{ 200 to 210	{ Saline, sulphureted, &c.	} Do.
Geyser Springs, Geyser Springs, Sonoma County.	30	1,000	212	Alkaline	Used commercially and as a resort.

*Mineral springs of California—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Geyser Soda Spring, Litton's Station, Sonoma County. <sup>1</sup>	1	.....	° 27	.....	Used commercially and as a resort.
Gilroy Hot Springs, 9 miles northeast of Gilroy, Santa Clara County.	} .....	.....	{ 109 to 115 }	.....	Resort.
Glen Alpine Mineral Springs, near Falling Leaf Lake, south of Lake Tahoe, El Dorado County.	.....	.....	.....	Alkaline, carbonated.	.....
Gordon's Spring, Lake County	.....	.....	.....	.....	.....
Grizzly Cañon Springs, east of Clear Lake, Lake Co.	.....	.....	.....	.....	.....
Harbin Springs, Lake County, 20 miles north of Calistoga.	} .....	.....	{ 118 to 120 }	Saline, sulphureted.	} Do.
Hatchinbama Lake, 4 miles west of Borax Lake, southeast of Clear Lake, Lake Co.	.....	.....	.....	Alkaline.	.....
Hensley's Mineral Springs, Tehama Co.	.....	.....	.....	Chalybeate	.....
Hibbs's Soda Springs, 62 miles north of Redding, Shasta County.	.....	.....	.....	.....	.....
Highland Springs, Highland Springs, Lake County.	} 10	.....	{ 60 to 82 } 100	Alkaline.	Do.
High Rock Spring, 9 miles east of Honey Lake, Lassen County.	.....	.....	.....	.....	.....
Hot Borate Spring, near Lakeport, Lake County.	1	18,000	.....	Alkaline, saline.	.....
Hot Mud Springs, on Shovel Creek, near the State line, Siskiyou County.	.....	.....	.....	Sulphureted	Do.
<i>Hot springs:</i>					
Two miles north of Fort Bidwell, Modoc County.	.....	.....	.....	.....	.....
In Surprise Valley, east side of Middle Alkali Lake, opposite Cedarville, Modoc County.	.....	.....	180	.....	.....
Three miles east of Canby, Modoc Co.	.....	.....	.....	do	.....
On east side of Middle Alkali Lake, 7 miles southeast of Cedarville, Modoc County.	.....	.....	.....	.....	.....
At base of Warner range, south end of Lower Alkali Lake, Modoc Co.	.....	.....	.....	.....	.....
On west side of Lower Alkali Lake, Modoc County.	.....	.....	.....	.....	.....
Between Upper and Middle Alkali Lakes, Modoc County.	.....	.....	.....	.....	.....
Nine to 13 miles northwest of Bridgeport, Mono County.	.....	.....	.....	.....	.....
One and a half miles southeast of Bridgeport, Mono County.	.....	.....	.....	.....	.....
Near Benton, Mono County.	.....	.....	138	.....	.....
In Long Valley, 5 miles east of Geyser, Mono County.	.....	.....	.....	.....	.....
On east side of Hot Spring Cove, Paoha Island, Mono Lake, Mono Co.	.....	.....	110	.....	.....
In Amador County, in valley west of Markleeville.	.....	.....	.....	.....	.....
Four miles south of Bear Valley, Colusa County.	.....	.....	.....	.....	.....
On east and west sides of Owen's River, in valley south of Bishop's Creek, Inyo County.	.....	.....	.....	.....	.....
Six miles west of Panamint, Inyo Co.	.....	.....	.....	.....	.....
On Armagosa Creek, west of Dry Salt Lake, Inyo County.	.....	.....	.....	.....	.....
Seven miles southwest of Kernville and 5 miles northwest of Havilah, Kern County.	.....	.....	.....	.....	.....
South of Rafael Peak, Ventura Co.	.....	.....	195	.....	.....
Five miles south of Santa Barbara, Santa Barbara County.	} .....	.....	{ 112 to 118 }	Sulphureted	{ Monticello Springs. † Hot
Head of Warner's Creek, southeast of Lassen's Peak, Plumas County.	.....	.....	.....	.....	.....

<sup>1</sup> Probably same as Geyser Spa Spring in list of analyses.

*Mineral springs of California* — Continued.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Hot springs</i> — Continued.					
Near head of Battle Creek, south of Lake Cañon, Plumas County.			85		
In Plumas County .....				Sulphureted, carbonated.†	
At bend of San Jacinto River, in northwest part of San Diego Co.					
Between Clear Creek and Pitt River, near Big Valley or Bieber, Lassen County.	2				
Ten or 12 miles northeast of San Juan Capistrano, Los Angeles Co.	}		{ 120 to 123 }		
Seven miles below Kernville, near Kern River, Kern County.			127	Sulphureted	
On summit of Mount Shasta, Siskiyou County.			180	do	
Hough's Spring, Hough Springs, Lake Co.			Cold		Resort.
Howard Springs, 3 miles from Adams Spring, Lake County.	} 14		{ 58 to 109 }	Saline, chalybeate, &c.	} Do.
Iron Spring, 2 miles north of Tom's Head Mountain, Tehama County.					
Lane's Spring, Stanislaus County .....					
Lane Mineral Springs, Calaveras Co. ....					
Las Cruces Hot Sulphur Spring, 42 miles from Santa Barbara, Santa Barbara Co.	1	500	90	Sulphureted	Used locally.
Little Geysers, 3 or 4 miles below the Geysers, Sonoma County.	}		{ 190 to 200 }		
Litton's Seltzer Spring, Litton's Station, near Healdsburg, Sonoma County.		20		Carbonated, alkaline.	Used commercially and as a resort.
Little Yosemite Soda Springs, North Fork of Kern River, Tulare County.			52	Carbonated and chalybeate.	
Lower Soda Spring, in Sacramento Valley, opposite mouth of Castle Creek, Shasta County.				Carbonated	
Madrone Mineral Spring, 6 miles north of Gilroy Hot Springs, Santa Clara Co.				do	Resort.
Magnetic Springs,? near Watsonville, Santa Cruz County.					Used commercially
Mark West Springs, America, on Mark West Creek, Sonoma County.	10	90		Thermal, sulphureted, and chalybeate.	Resort.
Matilija Hot Springs, 6 miles from Nordhoff, Ventura County.	} 28	8,000+	{ 35 to 160 }	Sulphureted	Do.
Mineral Spring of Grizzly Cañon, Lake County, near Wilbur Springs.					
McCarthy's Hot Springs, near Day's ranch, northeast of Fort Crook, Shasta County.					
Mills's Mineral Springs, 1 mile above Anderson's Springs, Lake County.	4		170	Saline, sulphureted.	Used locally as a resort.
<i>Mineral springs</i> :					
Twelve miles north of Wigginsville, Siskiyou County.					
On east slope of Mount Shasta, Siskiyou County.			Cold	Chalybeate	Unimproved.
West of Butteville, Siskiyou County.					
On mountain, near Silver Lake, Alpine County.					
In Salt Spring Valley, Calaveras Co.					
West Shore of Mono Lake, Mono Co.			Calcic		
On Encino ranch, Los Angeles Co. ....		83 to 87		Alkaline, carbonated.	
Three miles above Mouth of Little Creek Cañon, San Bernardino Co.		92			
Mono Basin Warm Springs, northeast shore of Mono Lake, Mono County.			85 to 90	Saline, alkaline	
Mono Lake, Mono County .....					
Mountain Glen Hot Springs, 25 miles north of Santa Barbara, Santa Barbara County.	}		{ 60 to 100 }	Sulphureted	Strongly mineralized. Local resort.

Mineral springs of California—Continued.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Mud springs:</i>			o		
Fifteen miles northeast of Honey Lake, Lassen County.					
On Antelope Creek, 10 miles east of Red Bluff, Tehama County.					
Napa Soda Springs, 7 miles from Napa City, Napa County.	27		68	Carbonated, saline.	Used commercially and as a resort.
Newson's Arroyo Grande Warm Springs, 2 miles from Arroyo Grande, San Luis Obispo County.	3+	49,000?	{ 40 to 100 }	Sulphureted	Resort.
Owen's Lake, south end of Owen's Valley, Inyo County.				Alkaline	
Pacific Congress Springs, 12 miles west of San José, Santa Clara County.			50	Saline, chalybeate.	Used commercially and as a resort.
Paert's Hot Springs, near Benton, Mono County.					
Paraiso Spring, Paraiso Springs, 7 miles south of Soledad, Monterey County.			118	Saline	Resort.
Pearson's Springs, 1 mile west of Witter's Spring, Lake County.	5		Cold	Alkaline, sulphureted.	Small resort.
Petroleum Spring, west shore of Hot Spring Cove, on island of Paoha, Mono Lake, Mono County.			96		
Piedmont White Sulphur Springs, 3 miles from Oakland, Alameda County.					
Salt Lake, east of Geyser, in Long Valley, Mono County.					
<i>Salt springs:</i>					
North of Inyo range, east of Black Mountain, Inyo County.					
East side Panamint Valley, Inyo Co.					
Eight miles south of bend of Furnace Creek, east side of Death's Valley, Inyo County.					
Near Armagosa Mines, San Bernardino County.					
On Salt Creek, Tehama County.					
Northeast of Patterson's Pass, Alameda County.					
On south side of Mokelumne River, 6 miles south of Silver Lake, Calaveras County.					
Eighty miles from Red Bluff, on Branch of Stony Creek, Trinity Co.					
Salt Wells, in Salt Wells Valley, between Borax Flats and Indian Wells, San Bernardino County.					
San Bernardino Hot Springs, north of San Bernardino, San Bernardino County.	}		{ 108 to 172 }	Calcic	
San Marcos Sulphur Springs, 7 miles northwest of Santa Barbara, Santa Barbara County.					
San Rafael Springs, San Rafael, Marin County.					
Santa Barbara Hot Sulphur Springs, 6 miles from Santa Barbara, in Santa Ynez Mountains, Santa Barbara Co.	}	7	{ 112 to 117 }	Sulphureted	Used locally.
Saratoga Spring, south end of Funeral Range, south of Death Valley, Inyo County.				Thermal	
Seigler Springs, near Adams Spring, Lake County.				Chalybeate	Resort.
Shafer's Hot Springs, north end of Henry Lake, Lassen County.			210		
Simmons's Hot Sulphur Springs, Sulphur Cañon, near Wilbur Springs, Colusa Co.			170	Sulphureted	Has a local reputation.
Skaggs's Hot Springs, 6 or 8 miles from Geyserville, Sonoma County.	}	3+	900	{ 128 to 140 }	Used commercially and as a resort.
Soda Lake in Saline Flats, on Mojave River, San Bernardino County.					
Soda Pond, north of Salt Lake, in Long Valley, Mono County.					

*Mineral springs of California — Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<i>Soda springs:</i>			o		
Eight miles below Salt Springs, east side of Death's Valley, Inyo Co.					
Eight miles east of Clear Lake, Lake County.				Alkaline, carbonated.	
On Linkville and Yreka Road, Siskiyou County.				do	
At Soda Bar, 2 miles from Oregon line, Siskiyou County.					
Southwest of Volcano Springs, San Diego County.					
East of Volcano Springs, San Diego County.					
At Forks of McCloud River, Shasta County.				Alkaline, carbonated.	
East of Lower Soda Springs, on branch of McCloud River, Shasta County.				do	
On Sacramento River, Siskiyou Co., near Shasta County line.			52	do	
Three miles northeast of Little Shasta, Siskiyou County.				do	
Nine miles west of Tuolumne River, west of Mono Pass, Tuolumne Co.				do	
Springs of Dos Palmas, in Coahuila Valley, San Diego County.			82	Saline	
Steamboat Springs, southeast of Lassen's Peak, Plumas County.					
Stewart's Hot Springs, in Warm Spring Valley, Modoc County.					
<i>Sulphur springs:</i>					
Four miles southwest of Tom's Head Mountain, Tehama County.					
West of San Fernando Peak, Ventura Co.					
Seven or eight miles east of Watsonville, Santa Cruz County.					
On Brown's Creek, Shasta County, southeast of Douglass City.					
On South Branch of West Fork of Sacramento, Shasta County.					
Few miles above mouth of Castle Creek, Shasta County.					
In Black Cañon, 3 miles north of Canby, Modoc County.					
Thirty miles south of Tulare Lake and 1 mile northwest of Buena Vista Lake, Kern County.					
Eight or ten miles west of south end of Tulare Lake, Kern County.				Saline	
On south side of San Fernando Mountain, Los Angeles County.					
Eight miles north of Black Butte, southern part of Shasta Valley, Siskiyou County.					
Seven miles north of county line, Monterey County, 20 miles from San Miguel Mission.					
In Mohawk Valley, Plumas County.					
Near Dry Lake, 15 miles northwest of Camp Cody, San Bernardino Co.					
Northeast of San Luis Mountains, San Luis Obispo County.					
Ten miles northeast of San Miguel Mission, San Luis Obispo County.					
Six miles south of McCormick's well, in Desert Valley, Inyo Co.					
South of Resting Spring, Inyo Co.					
Summit Soda Springs, near Soda Springs Station, Alpine County (1).			Cold	Alkaline, carbonated.	Not open now.
Tahoe or Cornelian Springs, on Lake Tahoe, near State line, Placer County.			131		Resort.
Tassajara Hot Springs, head of Arroyo Seco, Monterey County.					

Mineral springs of California — Continued.

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Thermal Acid Springs, in Coso Range, 12 miles east of Little Owen's Lake, Inyo County.			o		
Thermal springs:					
On Battle Creek, 5 miles above Morgan's Ranch, Plumas County.					
On Owen's River, opposite Black Rock, Inyo County.					
Near mines of Darwin, Inyo County					
Ten miles east of Telescope Peak, Inyo County.					
Tolenas Springs, 5 miles north of Suisun City, Solano County.	19	600+	65	Alkaline, carbonated.	Used commercially and as a local resort.
Tule River Soda Springs, South Fork of Tule River, east of Portersville, Tulare County.				do	
Tuscan or Lick Springs, 9 or 10 miles northeast of Red Bluff, Tehama Co.	3+		{ 66 to 80 }	Saline, sulphureted.	Local resort.
Ukiah Vichy Springs, 32 miles from Cloverdale, 2 miles from Ukiah, Mendocino County.			{ 81 to 90 }	Carbonated	Resort.
Vallejo Sulphur Springs, Vallejo, Solano County.			{ 80 to 90 }		
Vichy Springs of New Almaden, Santa Clara County, 50 miles south of San Francisco.				Alkaline, carbonated.	Do.
Volcanic Springs, near Volcano Station, Southern Pacific Railroad, San Diego County.					
Warm springs:					
Near head of Walker's Basin, Kern County.			100		
In Warm Spring Valley, 10 miles west of Alturas, Modoc County.					
On east side Pit River, on Hot Creek, north of Round Valley, Modoc Co.					
Twelve miles southwest of Camp Cody, San Bernardino County.					
Near Little Owen's Lake	1			Alkaline	
Nine miles from Amargosa mines, Inyo or San Bernardino County.					
Southwest of Pittville, Lassen Co.					
Warm Sulphur Springs, near Simms Valley, on Posa Creek, Kern County.					
Warner's Ranch Spring (Agua Caliente), 30 miles from San Diego, San Diego County.		1,400?	{ 74 to 142 }	Sulphureted.	Local resort.
Waterman's Springs, ¾ mile west of Arrowhead, San Bernardino County.					Private.
White sulphur springs:					
In Napa Valley, 2½ miles south of Saint Helena, Napa County.	9		{ 69 to 89.6 }	Sulphureted.	Resort.
Two miles north of Plymouth, Amador County.					
At edge of Panamint Range, 12 miles north of Panamint, Inyo County.					
In Santa Rosa, Sonoma County.					
In Bear Gulch, west or southwest of Red Bluff, Tehama County.					
Wilbur Springs, 30 miles from Colusa, Colusa County.				Sulphureted.	Has a local reputation.
Witter's Springs, 5 miles from Upper Lake, 3 miles from Blue Lake, Lake County.			Cold	Sulphureted, chalybeate.	Small resort.
Zen Zem Springs, southeast of Clear Lake, Lake County.			64	Saline?	

*Analyses of mineral springs in California.*

Constituents.	Adams Spring.	Ætna Springs.	Castalian Mineral Water.	California Seltzer Spring.	Calistoga Hot Springs.
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>	<i>Grains per gallon.<sup>d</sup></i>	<i>Grains per gallon.<sup>e</sup></i>
Sodium carbonate .....	57.04	75	1,724.11		3.41
Sodium bicarbonate .....				53.20	
Magnesium carbonate .....	99.02	14		45.20	
Calcium carbonate .....	28.71	10		70.40	
Iron carbonate .....	0.52			Trace	
Sodium sulphate .....		08	651.02		
Potassium sulphate .....					1.61
Magnesium sulphate .....					0.47
Sodium sulphide .....			46.34		
Sodium chloride .....	4.11	29	1,840.72	17.20	22.25
Potassium chloride .....			132.30		
Calcium chloride .....					3.26
Lime .....			Trace		
Magnesia .....			Trace		
Alumina .....					Trace
Silica .....	7.22	Trace	14.28	Trace	6.50
Boric acid .....			Trace		
Phosphoric acid .....			Trace		
Nitric acid .....	Trace				
Potassium .....	Trace				
Iodine .....			Trace		
Bromine .....			Trace		
Iron .....			Trace		
Organic matter .....	2.81		13.48		
Total .....	199.43	136	4,422.25	186.00	37.50
<i>Gases.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>			<i>Cubic inches.</i>
Carbonic acid .....	304.00	58		Abundant	
Sulphureted hydrogen .....					3.271

Constituents.	Thermal Acid Springs, Coso Range.	Springs of Dos Palmas.	El Paso De Robles Springs.		Fulton Wells.
			Hot Sulphur Spring.	Mud Spring.	
	<i>Parts in 100,000.<sup>f</sup></i>	<i>Parts in 100,000.<sup>f</sup></i>	<i>Grains per imp. gallon.<sup>g</sup></i>	<i>Grains per imp. gallon.<sup>g</sup></i>	<i>Grains per gallon.</i>
Sodium carbonate .....				5.21	
Sodium bicarbonate .....			50.74		2.20
Magnesium carbonate .....				3.10	
Magnesium bicarbonate .....			0.92		16.50
Calcium carbonate .....		Trace			
Calcium bicarbonate .....					12.00
Iron subcarbonate .....					13.00
Sodium sulphate .....	15.1		7.85	41.11	
Potassium sulphate .....	2.5		0.88	Trace	
Calcium sulphate .....	15.3	32.6	3.21	17.90	
Magnesium sulphate .....	1.2	31.0			
Aluminium persulphate .....	127.0				
Iron persulphate .....	33.2				
Sodium sulphide .....					0.90
Sodium chloride .....		230.8	27.18	96.48	10.40
Lithia .....	Trace				
Iron peroxide .....			0.36		
Ammonia .....	Trace				
Alumina .....			0.22		
Silica .....		Trace	0.44	1.11	
Phosphoric acid .....	Trace	Trace			
Nitric acid .....	Trace				
Sulphuric acid .....	78.4				
Sulphur .....					23.00
Chlorine .....	Trace				
Iodine .....			Trace		
Bromine .....			Trace		
Manganese .....		Trace			
Organic matter .....			1.64	3.47	
Total .....	272.7	294.4	93.44	168.38	78.00
<i>Gases.</i>			<i>Grains.</i>	<i>Grains.</i>	
Carbonic acid .....			10.50	47.84	Abundant
Sulphureted hydrogen .....			4.55	3.28	Abundant

<sup>a</sup> Thomas Price, analyst.<sup>b</sup> J. A. Bauer, analyst.<sup>c</sup> Thomas Price, analyst (1880).<sup>d</sup> F. A. Bower (?), analyst.<sup>e</sup> J. F. Rudolph, analyst.<sup>f</sup> Oscar Loew, analyst (1876).<sup>g</sup> Price and Hewston, analysts.

*Analyses of mineral springs in California — Continued.*

Constituents.	Azule Mineral Springs.	Geyser Spa Spring.	Hot Borate Springs.	Napa Soda Springs.
	<i>Grains per gallon.</i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>	<i>Grains per gallon.<sup>c</sup></i>
Sodium carbonate .....	50.88			
Sodium bicarbonate .....		23.48	76.96	13.12
Magnesium carbonate .....	77.20			26.12
Magnesium bicarbonate .....		9.80		
Calcium carbonate .....	9.50	4.56		10.88
Iron carbonate .....		3.80		
Iron subcarbonate .....				7.84
Ammonium bicarbonate .....			107.76	
Sodium sulphate .....		3.40		1.84
Calcium sulphate .....			Trace	
Sodium baborate .....			103.29	
Sodium chloride .....	90.88	9.96	84.62	5.20
Potassium chloride .....	12.44		Trace	
Magnesium chloride .....	18.48			
Magnesium iodide .....			0.09	
Magnesium bromide .....			Trace	
Alumina .....			1.26	0.60
Silica .....		1.80	8.23	0.68
Volatile matter .....			65.77	
Carbonic acid .....	152.24		36.37	
Loss .....		0.32		2.48
Total .....	411.12	57.12	484.35	68.76

Constituents.	Pacific Congress Springs.	Vichy springs of New Almaden.	Litton's Seltzer Spring.	Skaggs's Hot Springs.
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.</i>	<i>Grains per gallon.<sup>e</sup></i>	<i>Grains per gallon.<sup>f</sup></i>
Sodium carbonate .....	123.35	200.12		
Sodium bicarbonate .....				161.27
Magnesium carbonate .....				11.11
Calcium carbonate .....	17.29	32.00		2.20
Lithium carbonate .....				0.06
Iron carbonate .....				0.05
Iron bicarbonate .....	14.03			
Barium carbonate .....				0.24
Strontium carbonate .....				0.02
Sodium sulphate .....	12.14			
Potassium sulphate .....				0.26
Calcium sulphate .....		40.20		
Magnesium sulphate .....		12.00		
Sodium baborate .....				26.47
Sodium chloride .....	119.16	32.16		5.90
Potassium chloride .....				0.20
Sodium iodide .....				Trace
Soda .....			62.19	
Lime .....			4.41	
Magnesia .....	Trace		5.24	
Iron oxide .....			2.85	
Alumina .....	} 49.88 {			0.01
Silica .....				7.02
Carbonic acid .....		112.08	42.96	
Sulphuric acid .....			2.36	
Chlorine .....			78.38	
Iron .....		4.08		
Organic matter .....			\$27.38	
Total .....	335.85	432.64	228.69	214.81

<sup>a</sup> Bauer or Price, analyst.<sup>b</sup> Moore, analyst.<sup>c</sup> L. Lanzwurt, analyst.<sup>d</sup> Bauer (!), analyst.<sup>e</sup> Henry G. Hanks, analyst.<sup>f</sup> E. W. Hilgard, analyst.<sup>g</sup> Potassa, lithia, ammonia, alumina, and boracic acid included.

*Analyses of mineral springs in California—Continued.*

Constituents.	Highland Springs.			Little Yosemite Soda Spring.	Mineral Spring, Encino Ranch.
	Seltzer Spring.	Dutch Spring.	Magic Spring.		
	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Grains per gallon.<sup>a</sup></i>	<i>Parts in 100,000.<sup>b</sup></i>	<i>Parts in 100,000.<sup>b</sup></i>
Sodium carbonate .....	8.87	12.72	15.10	20.97	24.31
Magnesium carbonate .....	20.67	40.08	41.63	} 16.02	} 32.17
Calcium carbonate .....	34.76	39.80	35.02		
Potassium carbonate .....	0.38	0.58	0.42		
Manganese carbonate .....	Trace	Trace	Trace		
Iron carbonate .....	0.92	0.98	0.78	0.92	
Sodium sulphate .....				Trace	54.46
Sodium chloride .....	0.72	1.65	1.28	4.68	2.93
Alumina .....	1.56	0.11	0.17		
Silica .....	5.24	7.12	7.39	7.31	11.50
Phosphoric acid .....					Trace
Sulpho-hydric acid .....					Trace
Potassium .....					Trace
Lithium .....					Trace
Organic matter .....	Trace	Trace	Trace		
Total .....	73.12	103.04	101.79	49.90	125.37
<i>Gas.</i>					
Carbonic acid .....	<i>Cubic inches.</i> 212.20	<i>Cubic inches.</i> 184.80	<i>Cubic inches.</i> 156.80	In excess	In excess

  

Constituents.	Mono Lake.	Hot Spring on Paoha Island, Mono Lake.	Soda Lake, Saline Flats on Mojave River.	Sulphur Spring, south side of San Fernando Mt.	Mono Basin Warm Springs.
	<i>Grams per liter.<sup>a</sup></i>	<i>Grams per liter.<sup>a</sup></i>	<i>Parts in 100,000.<sup>b</sup></i>	<i>Parts in 100,000.<sup>b</sup></i>	<i>Grams per liter.<sup>c</sup></i>
Sodium carbonate .....	19.4900	0.0506		6.21	0.5972
Magnesium carbonate .....	0.3600				
Magnesium bicarbonate .....		0.0154		} 50.60	} 0.2114
Calcium carbonate .....	0.6800	0.1035			
Sodium sulphate .....	10.0700	0.0799	63.1	23.87	0.1475
Calcium sulphate .....			21.2		0.4631
Magnesium sulphate .....			8.5		
Sodium baborate .....	0.2000				
Sodium silicate .....					0.2480
Sodium chloride .....	18.2200	0.0104	170.8	Trace	0.2799
Potassium chloride .....	2.2300	0.0169			0.1203
Alumina .....					0.0018
Silica .....	0.2800	0.0178	Trace	Trace	
Phosphoric acid .....			Trace	Trace	
Sulpho-hydric acid .....				5.00	
Potassium .....			Trace	Trace	
Lithium .....			Trace	Trace	
Iron .....				Trace	
Manganese .....				Trace	
Organic matter .....			19.0	Trace	
Loss .....	0.3200				0.0158
Total .....	51.8500	0.2945	282.6	85.68	2.0850
<i>Gas.</i>					
Carbonic acid .....				In excess	

<sup>a</sup> Prof. Rising, analyst.<sup>b</sup> Oscar Loew, analyst, 1876.<sup>c</sup> T. M. Chatard, analyst.

*Analyses of mineral springs in California—Continued.*

Constituents.	Santa Barbara Springs.		San Bernardino Springs.	
	No. 1, main spring, Hot Spring Cañon.	No. 2, main spring, Side Cañon.	No. 1, large spring in front of hotel.	No. 2, spring 200 yards west of hotel.
	<i>Parts in 100,000.<sup>a</sup></i>	<i>Parts in 100,000.<sup>a</sup></i>	<i>Parts in 100,000.<sup>a</sup></i>	<i>Parts in 100,000.<sup>a</sup></i>
Sodium carbonate .....	29.6	24.8	Trace	Traces
Magnesium carbonate .....			10.7	11.0
Calcium carbonate .....			Trace	Traces
Iron carbonate .....	5.0	Trace	81.7	80.2
Sodium sulphate .....			2.3	Trace
Potassium sulphate .....	8.7	7.6	12.8	13.4
Sodium chloride .....	Trace	Trace		
Potassa .....	4.2	6.0	20.5	22.4
Silica .....	Trace	Trace		
Carbonic acid .....	Trace	Trace		
Sulpho-hydric acid .....	Trace	Trace		
Calcium .....	Trace	Trace		
Total .....	47.5	38.4	128.0	127.0

  

Constituents.	Springs near San Juan Capistrano, main spring.	Agua Caliente of Cabezon Valley.	Warm Spring, near Little Owen's Lake.	Ukiah Vichy Springs.
	<i>Parts in 100,000.<sup>a</sup></i>	<i>Parts in 100,000.<sup>a</sup></i>	<i>Parts in 100,000.<sup>a</sup></i>	<i>Grains per gallon.<sup>b</sup></i>
Sodium carbonate .....	11.10	8.3	45.2	197.75
Magnesium carbonate .....			Trace	22.64
Calcium carbonate .....			12.0	17.85
Sodium sulphate .....	Trace	Trace	8.0	Trace
Potassium sulphate .....				Trace
Sodium chloride .....	10.53	31.0	26.9	27.51
Potassium chloride .....				Trace
Potassa .....	Trace		Trace	
Lime .....	Trace	Trace		
Magnesia .....	Trace	Trace		
Lithia .....	Trace	Trace		
Iron .....				} Trace
Alumina .....				
Silica .....	7.66	Trace	Trace	6.86
Sulpho-hydric acid .....		Trace		
Organic matter .....		Trace	Trace	
Total .....	29.29	39.3	92.1	272.61

<sup>a</sup>Oscar Loew, analyst (1876).<sup>b</sup>John Hewson, jr., analyst.

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*Analyses of mineral springs in California—Continued.*

Constituents.	Summit Soda Spring.	White Sulphur Springs, Saint Helena.		
		Spring No. 2.	Spring No. 6.	Spring No. 7.
	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. per gall.<sup>b</sup></i>	<i>Grs. per gall.<sup>b</sup></i>	<i>Grs. per gall.<sup>b</sup></i>
Sodium carbonate.....	9.50			
Magnesium carbonate.....	4.20	0.62	0.56	4.36
Calcium carbonate.....		1.25	2.44	5.56
Calcium bicarbonate.....	43.20			
Sodium sulphate.....		8.26	11.33	12.84
Sodium sulphide.....		}		
Calcium sulphide.....			1.85	1.62
Sodium chloride.....	26.22	21.72	23.41	14.23
Calcium chloride.....		1.32	0.86	0.78
Magnesium chloride.....		0.87	2.22	0.65
Potassa.....	Trace			
Iron oxide.....	1.75			
Alumina.....	1.75			
Silica.....	2.06			
Total.....	88.68	36.69	42.67	40.04
<i>Gas.</i>				
Sulphureted hydrogen.....	<i>Cubic inches.</i> 186.35	<i>Cubic inches.</i> 6.15	<i>Cubic inches.</i> 4.25	<i>Cubic inches.</i> Trace

  

Constituents.	Paraiso Spring.	Volcanic Springs.	Tolenas Springs.	Shafer's Hot Springs.
	<i>Grs. per gall.<sup>c</sup></i>	<i>Grs. per gall.<sup>d</sup></i>	<i>Grs. per gall.<sup>e</sup></i>	<i>Grams per liter.<sup>f</sup></i>
Sodium carbonate.....	4.23	1,724.11	53.36	
Magnesium carbonate.....			10.88	
Calcium carbonate.....	1.43		48.32	
Iron carbonate.....			0.64	
Sodium sulphate.....	35.50	651.02		0.4715
Calcium sulphate.....	4.32			0.0409
Magnesium sulphate.....				0.0020
Sodium biborate.....			20.56	
Sodium silicate.....				0.0613
Sodium sulphide.....		46.34		
Sodium chloride.....	3.50	1,840.72	215.92	0.3266
Potassium chloride.....	0.35	132.30	5.68	0.0180
Potassium iodide.....			2.08	
Lime.....		Trace		
Magnesia.....	Trace	Trace		
Iron oxide.....	}	Trace		
Alumina.....			0.96	
Silica.....	2.62	14.28	1.60	0.1008
Boracic acid.....		Trace		
Phosphoric acid.....		Trace		
Iodine.....		Trace		
Bromine.....		Trace		
Organic matter.....	5.25	13.48		
Total.....	58.80	4,422.25	360.00	1.0211

<sup>a</sup> J. F. Rudolph, analyst.<sup>b</sup> J. Le Conte, analyst (1871).<sup>c</sup> A. Cihí, analyst (1871).<sup>d</sup> Dr. Price, analyst.<sup>e</sup> John Hewson, jr., analyst.<sup>f</sup> F. W. Clarke, analyst (1883).

## OREGON.

Oregon is well supplied with valuable mineral springs, both hot and cold. The thermal springs are numerous, and, as in Nevada and Utah, are found mainly in connection with faulted strata. Carbonated springs are also frequently found, and, with alkaline and sulphureted waters, comprehend most of the varieties found in the State. Chittenden's Health and Pleasure Resorts of the Pacific Coast for 1879 contains the best list heretofore published, but it is not complete for the present time. The present list has been made up mainly from reports obtained directly from the localities. Various maps have also been consulted, and Mr. Mark B. Kerr and Mr. Eugene Ricksecker have furnished data as to springs in the southern counties of the State. A considerable number of the springs have been improved and are utilized as resorts.

*Mineral springs of Oregon.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Aurora Saline Springs, $1\frac{1}{2}$ miles west of Aurora Mills, Marion County.	2	600	57	Calcic, saline ...	Used to some extent as a resort.
Belknap Hot Springs, near McKinzie Bridge, Lane County.	7	1,260	184	.....	Resort.
Canter's Blue Sulphur Springs, Jordan Valley, Baker County, west of Silver City, Idaho.	8	.....	200	.....	Used as a local resort.
Cole's Soda Springs, 3 miles west of White Point, Jackson County.	.....	.....	.....	.....	Resort.
Cooper's Springs, 1 mile east of Wilbur, Douglas County.	.....	.....	.....	.....	Unimproved.
Cullen's Springs, Yam Hill County ...	.....	.....	.....	.....	.....
Des Chutes Hot Springs, 8 miles north of Warm Spring, Crook County. }	.....	.....	{ 143 } to { 145 }	Alkaline, saline.	Do.
Foley Springs, near McKinzie Bridge, Lane County.	.....	.....	188	.....	Resort.
<i>Hot springs:</i>					
Near Lakeview, Lake County.....	.....	.....	.....	.....	.....
On Malheur River, near mouth, Baker County.	1+	.....	193	.....	.....
At base of Stein Mountains, Grant County.	.....	.....	168	.....	.....
At north end of Quinn River Valley, Baker County.	.....	.....	.....	.....	.....
On northwest side of Goose Lake, Lake County.	.....	.....	.....	.....	.....
In Warner Lakes Valley, Grant Co.	.....	.....	.....	.....	.....
Four miles south of Lakeview, Lake County.	.....	.....	.....	.....	Local resort.
On Cheeseman's Ranch, 1 mile north of Lakeview, Lake County.	.....	.....	.....	.....	Do.
Kitson's Springs, Dexter, Lane County.	.....	.....	.....	.....	.....
Linkville Springs, near Linkville, Klamath County.	4+	.....	Hot	.....	One is improved; used as a resort.
Lower Soda Spring, south fork of Santiam River, Linn County.	.....	.....	.....	Alkaline, carbonated.	Resort.
Malheur River Springs, branch of Malheur River, Baker County.	.....	.....	.....	.....	.....
McCalister's Soda Springs, 35 miles east of Jacksonville, Jackson County.	.....	60	.....	.....	Used commercially and as a resort.
<i>Mineral springs:</i>					
Twelve miles east of Jacksonville, Jackson County.	.....	.....	.....	Carbonated .....	.....

*Mineral springs of Oregon—Continued.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
<b>Mineral springs—Continued.</b>					
On West Fork of Beaver Creek, Jackson County.	2	.....	.....	Chalybeate and carbonated.	Unimproved.
Three miles south of Aurora Mills, Marion County.	.....	.....	.....	.....	.....
In Willamette Valley, 50 miles above Eugene City, Lane County.	2	.....	.....	.....	Resort.
On Blue Mountains, near John Day, Grant County.	1	.....	120	.....	Do.
Six miles southeast of Astoria, Clatsop County.	.....	.....	.....	Carbonated.	.....
In Sam's Valley, Jackson County.	.....	.....	.....	Sulphureted	.....
On W. Allen's farm, near East Portland, Multnomah County.	.....	.....	.....	Chalybeate	.....
Payton or Snowden Mineral Spring, 2 miles south of Drain's Station, Douglas County.	1	225	57	Alkaline.	Used commercially and as a resort.
<b>Soda springs:</b>					
Near Jacksonville, Jackson Co.	.....	.....	.....	Carbonated	Do.
At Waterloo Falls, 3 miles above Sodaville, Linn County.	.....	.....	.....	do	Unimproved.
Six miles from Ashland, Jackson Co.	.....	.....	.....	.....	.....
At Brownsborough, Jackson Co.	.....	.....	.....	.....	.....
On Molalla River, Clackamas Co.	.....	.....	.....	.....	.....
Sodaville Spring, Sodaville, Linn Co.	1	15	45	Carbonated	Free resort.
Solfataire, near Linkville, Klamath Co.	.....	.....	.....	.....	Used for vapor baths
<b>Sulphur springs:</b>					
At Sulphur Springs, on Smith's Fork of Umpqua River, Douglas County.	.....	.....	.....	.....	Unimproved.
One mile above Sulphur Springs Douglas County.	.....	.....	.....	.....	Do.
Upper Soda Springs, Santiam River, 10 miles above Lower Soda Springs, Linn County.	.....	.....	.....	.....	.....
<b>Warm springs:</b>					
Northeast of Summerville, Union County.	.....	.....	.....	.....	.....
West of Malheur Lake, Grant Co.	.....	.....	.....	.....	.....
In Summit Lake Valley, Lake Co.	.....	.....	.....	.....	.....
Wilhoit's Soda Springs, Clackamas Co., Rock Creek, 25 miles northeast of Salem.	7	700+	35	Alkaline.	Used commercially and as a resort.
White Sulphur Springs, head of Clackamas River, Clackamas County.	.....	.....	.....	.....	.....
<b>Hot springs:</b>					
In Horsefly Valley, southwest of Drew's Valley, Lake County.	.....	.....	.....	.....	.....
On Lost River, west of Bonanza, Lake County.	.....	.....	.....	.....	.....

*Analyses of mineral springs in Oregon.*

Constituents.	Des Chutes Hot Springs.	Wilhoit's Soda Springs.	Aurora Saline Springs.	Foley Springs.
	<i>Grs. per gall.<sup>a</sup></i>	<i>Grs. per gall.<sup>b</sup></i>	<i>Grs. per gall.<sup>c</sup></i>	<i>Grs. per gall.<sup>d</sup></i>
Sodium carbonate.....	34.50	87.57		
Magnesium carbonate.....		85.32		
Calcium carbonate.....		32.23	Trace	
Iron protoxide carbonate.....		6.00		
Sodium sulphate.....	9.46	3.40		
Magnesium sulphate.....		6.45		
Calcium sulphate.....	1.82			
Sodium chloride.....	20.42	201.00	356.00	75.00
Potassium chloride.....	2.00			
Magnesium chloride.....	1.21		19.87	
Sodium silicate.....	8.20			
Iron.....	Trace			
Iodine.....		Trace		
Calcium chloride.....			474.13	90.00
Iron carbonate.....			Trace	
Silica.....			10.61	
Organic matter.....			1.01	
Undetermined.....				21.00
Total.....	77.61	421.97	861.62	186.00
<i>Gas.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>	<i>Cubic inches.</i>
Carbonic acid.....	22.56	3.3844		

Constituents.	Kitson's Springs.		Cooper's Springs.	Payton Mineral Spring.
	Cold Spring.	Hot Spring.		
	<i>Grs. per gall.<sup>d</sup></i>	<i>Grs. per gall.<sup>d</sup></i>	<i>Grs. per gall.<sup>d</sup></i>	<i>Grs. per gall.<sup>e</sup></i>
Magnesium sulphate.....	{ 28.00 }			
Calcium sulphate.....				
Sodium chloride.....	180.00	208.00	128.00	113.00
Magnesium chloride.....				145.00
Calcium chloride.....	48.00	64.00	190.00	115.00
Iron carbonate.....				62.00
Undetermined matter.....		42.00	34.00	
Total.....	256.00	314.00	352.00	435.00

<sup>a</sup> L. N. Dornbach and E. N. Horsford, analysts.

<sup>d</sup> R. G. Rex, analyst.

<sup>e</sup> With calcium, carbonate and loss.

<sup>b</sup> J. A. Veatch, analyst (1869).

<sup>e</sup> Philip Harvey, analyst (1876).

<sup>b</sup> With magnesia, alumina, and silica.

<sup>c</sup> J. H. Bell, analyst (1870).

<sup>f</sup> With insoluble matter.

WASHINGTON.

The list of mineral springs for Washington Territory is as yet small, and, so far as known, this is the first attempt to enumerate them. Walton mentions but one locality, viz, Medical Lake, which is at present the only one at which the water is put up for sale. The water is condensed and bottled and the evaporated salts are also put up in packages, which are extensively sold. There is but one other locality in the Territory used as a resort. As the country becomes more fully settled there will doubtless be other localities improved and many new ones added to the table.

The present list has been compiled partly from maps and partly from letters received from various portions of the Territory.

*Mineral springs of Washington Territory.*

Name and location.	Number of springs.	Flow in gallons per hour.	Temperature, Fahr.	Character of the water.	Remarks.
Alkaline Springs, in Crab Creek Cou- lée, Spokane County.			o		
Brackett Spring, Edmonds, Snohom- ish County.	1	65	57		Unimproved.
Cascade Warm Mineral Springs, Cas- cades, Skamania County.	4	160	96	Saline, sulphu- reted.	Resort.
Chalybeate Springs, Clallam County.					
Deuny Springs, King County	2	1,640	48	Saline	Unimproved.
<i>Hot springs:</i>					
On Green River, west slope of Cas- cade Mountains, 50 miles north from Seattle, King County.					
Medical Lake, Medical Lake, Spo- kane County.			60	Alkaline, saline.	Used commercially and as a resort.
Pinkham Mineral Spring or Well, Lake Union, near Seattle, King County.				Calcio	
Saline Springs, east end of Rattlesnake Mountains, Yakima County.					
<i>Salt and alkaline lakes:</i>					
North of Saddle Mountain, Spo- kane County.					
North of Fort Okinakane, Stevens County.					
Soda Spring, near Goldendale, Kliki- tat County.					Unimproved and difficult of access.
Sulphur Lake, east of Palouse Junc- tion, Whitman County.					
Sulphur Spring, southeastern part of Garfield County.					
Thermal Wells, Ainsworth, Whitman County.			60		

*Analysis of mineral spring in Washington Territory.*

Constituents.	Medical Lake.
	<i>Grs. per gall.*</i>
Sodium carbonate	63.543
Lithium carbonate	Trace
Magnesium carbonate	0.233
Iron carbonate	0.526
Calcium carbonate	0.186
Sodium chloride	16.370
Potassium chloride	9.241
Alumina oxide	0.175
Sodium metasilicate	10.638
Potassium sulphate	Trace
Sodium diborate	Trace
Organic matter	0.551
Total	101.463

\*G. A. Mariner, analyst (1882).

## ALASKA.

According to Dr. William H. Dall (from whose Alaska and Its Resources the list given here is mainly compiled), the hot and mineral springs of Alaska are both numerous and important. Besides the hot springs there are many which do not freeze even during the most severe winter weather, and which, therefore, are properly included under the

head of thermal springs. Hot springs are most numerous on the list, which may be due partly to the fact that such springs naturally attract most attention, especially in a new country. Chalybeate, sulphureted, and saline springs are also found. The springs enumerated by Dall are supplemented in the table by several others, two of which are taken from a book by Frederick Whympier, one from the Pacific Coast Pilot for 1869, and two from Walton's Mineral Springs, in which they are reported by Dr. H. J. Phillips, of the United States Army. Several localities have been added by Sheldon Jackson. So far as learned, none of the waters of the Alaskan mineral springs has ever been analyzed.

*Mineral springs of Alaska.*

Name and location.	Temperature, Fahr.	Character of the water.	Remarks.
Boiling springs on northeast side of Akutan Island ..	o	Saline? .....	Used by Aleuts from time immemorial for cooking purposes.
Boiling springs on Kánaga Island.....	.....	.....	
Boiling mud springs on Koni volcano, Atka Island...	.....	Sulphureted .....	
Chalybeate spring, $\frac{1}{2}$ mile from Sitka, Baranoff Island.	.....	.....	
Chalybeate spring on west bank of Chilkat River, on the mainland.	.....	.....	Was used as the site of hospital by the Russians, and the springs were used extensively.
Geysers, or warm sulphur springs, Sitka Sound, 15 or 20 miles from Baranoff Island.	*153 $\frac{1}{2}$	Saline and sulphureted.	
Hot springs, 5 miles from Korovni Bay, Atka Island ..	167	Saline?.....	Used by Aleuts for bathing.
Hot springs between Korovni and Klucheff volcanoes, Atka Island.	.....	.....	
Hot springs on Adakh Island .....	.....	.....	
Hot springs in Parenosa Bay, on south coast of Aliaska Peninsula.	.....	.....	
Hot springs in Port Möller, north side of Aliaska Peninsula.	.....	.....	
Hot spring in crater of Goreloi, Goreloi Island .....	.....	.....	
Hot springs on Amagat Island, near Aliaska Peninsula.	.....	.....	
Hot Springs on a small island southeast of Akhün ...	.....	.....	
Hot Springs on Chichagoff Island, east of Siwash passage.	.....	.....	
Hot marshes near Pogrimnoi volcano, Unimak Island	.....	.....	
Hot springs on Stikine River, 25 miles above its mouth.	.....	.....	
Hot springs on Sitignak Island .....	.....	.....	
Hot springs on Segouam! Island .....	94	Sulphureted .....	
Hot springs opposite Iliuluk or Captain's Harbor, on Unalaska Island	.....	.....	
Hot springs near Makushin Mountain, Unalaska Island.	.....	.....	Used for bathing by the Aleuts.
Hot Springs near Deep Bay, Unimak Island.....	212	.....	
Intermittent boiling springs, in a small valley of Unimak Island.	.....	.....	The temperature of the air was —8° Fahr.
Saline lake on Beaver Island in the Pribyloff Group..	.....	.....	
Sulphur lake on Unimak Island .....	.....	.....	
Warm springs on Unalaklik River, near Ulukuk .....	34	Saline?.....	
Warm springs between Versola Sofke and Youkon River.	.....	.....	

\* This is the temperature given in the Coast Pilot. Dall gives a temperature of 122° F., and Dr. Phillips, in Walton's book, gives 96° F. to 104° F.

## RECAPITULATION.

The totals in the following table are somewhat greater than those given in the summary on page 986 of Williams's Mineral Resources of the United States, 1883-'84, as additional data have been received since the publication of that report.

States.	Number of spring lo- calities.	Number of individual springs.	Number of springs analyzed.	Number of springs utilized as resorts.	Number of springs used com- mercially.	Total num- ber of analyses.
Northern Atlantic States ...	405	657	155	74	72	187
Southern Atlantic States ...	371	1, 048	148	152	42	164
Southern Central States ...	721	1, 911	137	174	36	146
Northern Central States ....	601	1, 276	215	122	55	224
Western States and Terri- tories.	724	3, 951	132	112	18	138
Grand total.....	2, 822	8, 843	787	634	223	859

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